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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 23 NEW YORK, THURSDAY, JANUARY 18, 1900 NUMBER 3

Published at 218 William St., New York,
Every Thursday by the

American Machinist Press.

[INCORPORATED.]

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Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$3 per year in advance, postage paid, in North America.
$4 per year in foreign countries, postage prepaid.
No back numbers beyond current year.
For sale by newsdealers, generally.

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Entered at New York P. O. as second-class mail matter.

Cable address, "MACHINIST," N. Y.
Lieber's and A B C Codes.

A Bit of Foreign Experience.

The experience of one American mechanic who went to Europe some years ago to take charge of a new manufacturing enterprise ought to be instructive as well as interesting.

In this case little, if any, of the needed machinery had been installed, and it was purchased here in America, the selection being based upon American experience in the same line of work. The expert workmen that were to go over to help our friend, because that was part of the original arrangement, and some of the men had been tentatively engaged, never went over, because the time seemed never to come when the proprietors were ready to send for them, probably having concluded that such expensive men were unnecessary and that so long as they had one man in the institution who knew how the work was to be done the necessary muscular energy could as well be supplied by the native help, working at much lower wages. So there was nothing else for the American to do but to take the most likely of the bench hands and train them for the leading positions; a process which, of course, was attended by many great difficulties arising from unacquaintance with the language and from the fact that the American had, of course, enough to do without having at the same time to instruct his various subordinates in the elements of the business. Some of the difficulties arose, too, from the utter misconception on the workmen's part of what was expected of them and their entirely different attitude toward the superintendent and the proprietors from that which is customary here.

For instance, when "Monsieur le Directeur," as our friend was called, appeared in the shop every cap was doffed in an obsequious salute. This is what is expected and required there, and the native "Director" who should observe its omission by any workman would conclude that discipline was not being properly maintained and that the shop personnel needed an overhauling, so to speak. To the American, however, it very naturally seemed an absurdity and soon became a nuisance. Finally, he assembled the men together and talked to them about this and some similar matters. He told them he wanted no cap lifting nor any other form of salute every time he appeared; that he would be much better pleased if every man would be so busy with his work as not to notice who was walking about the shop; that it was some such strict attention to business that enabled machines to be made cheaply; that they and he were there to make machines as cheaply as possible, and not to spend their time in watching each other nor to observe customs and practices supposed to indicate that one man was necessarily better than others. He told them that if they would devote their time and energies strictly to the work and get it out in the best possible manner with the least possible waste and expense, the establishment would be successful as a manufacturing enterprise; that he was there to help them to do this; not to drive them nor tyrannize over them, and that for every man who did his best with the work there was a prospect of better wages and advanced position. This seemed to be a revelation to these men. His talk to them became the talk of the town, but they appreciated it, and nearly every one of them did try to do the best he could. Of course, they were entirely ignorant of the proper way to go about the work with modern tools, and the record of breakages was simply appalling at first, most of which breakages could probably have been avoided, however, had the other Americans who had been promised as assistants been allowed to go over.

Our friend made a point of never seeming to be out of patience with the men, even when they made the most egregious blunders. He let them see that he took it for granted that they were doing the best they could, and patiently showed them how to avoid such occurrences in the future. The men were never cursed at nor abused, either by himself or by any of the heads of departments, and were thus never unnecessarily rattled or made nervous and apprehensive.

The result was described as truly remarkable as regards most of the men. Being respected by "M. le Directeur," they respected themselves and each other; they evinced in most cases considerable ambition and an ardent desire to perfect themselves in their work and improve in it as much as possible. Perceiving this, our friend thought to do still more for them, and used to get a number of them together in his room on certain evenings, where he talked to them on matters connected with the business and endeavored to give them something of an idea of what hights to which it was possible to rise in it where one has the opportunity and the ambition to do so. The appreciation of all this that was shown by most of the men was exceedingly gratifying, and the American felt well repaid by their gratitude and appreciation, as well as by the better results that he was constantly getting in the factory as compared with what he knew he would have gotten had the men remained a mere "inert mass," satisfied to exert their muscles in the manner in which they were directed and to satisfy merely the elementary physical needs of existence. The world and life in it had taken on a new and previously undreamed of meaning to them; they had learned that even a poor workman may be allowed and even encouraged to think and to have ambitions—to dream of rising in the world somewhat above the position occupied by his father, his grandfather and his great grandfather.

The only opposition to all this came from the proprietors of the establishment. They remonstrated about it—said that such a thing as having laborers in one's

room and treating them as something like social equals was subversive of all proper discipline; they knew far more about native workmen, they said, than any foreigner could possibly know, and they knew they had to be kept strictly in their places or there would be trouble. The men were getting new ideas into their heads that could only injure them; the thinking that was done in manufacturing establishments should be done by educated engineers and the gentlemen proprietors. These workmen were already getting extravagant notions about wages and the high wages paid to some of them were already producing uneasiness in some of the other factories in the neighborhood.

From disapproval of improved men they soon went on to disapproval of better methods that were proposed from time to time, and as men will under such conditions, finally began to imagine that they had seen enough of modern American methods of manufacture to be quite well acquainted with them and to be able to have opinions about the desirability or non-desirability of any proposed plan. In order to carry out this idea it was, of course, necessary for them to oppose some propositions and insist upon doing some things their way, and the fact that their way always turned out to be either a flat failure or only partially successful seemed to make no difference nor to discourage them in the least. Finally, this became unbearable, and the American quit. Many of the workmen had come to look upon him as the best friend they had ever known, and some actually shed tears upon parting with him. The proprietors were indifferent; they imagined that they could easily keep the factory going as the American had started it, and expected also to do it with a less expensive man as superintendent. They have yet to learn that a factory either progresses or falls behind, and that no such thing is possible as that it can stand still, and in the meantime the best of the men who see that there is a decided retrograde movement and who are offered positions elsewhere, promptly accept them, the achievements of the factory having made a demand for the best of the men for positions of responsibility elsewhere.

One of these men, who had never been nor ever dreamed of being anything else than a despised laborer, satisfied to work at wages barely sufficient to afford the meanest necessaries of existence, has developed into a good machinery salesman, and is at present engaged in the work of introducing American tools there. He not only learned the tools rapidly, but seemed to have a natural talent for business, and is doing very well indeed, though it is quite certain that he owes his success entirely to the accident which brought him into contact with one who recognized his manhood, and who was ready to help him to make the best of himself.

Afterward, in another connection, it became the duty of our friend to visit shops and to advise with the proprietors as to the best tools to put in to do the work they had been doing with tools of ancient British origin or copies of them. In this work there were naturally many very strange adventures and experiences. In one shop they seemed to have an idea that the bluntness of lathe centers should increase with the size of the work and with the cuts taken. He sold them an axle lathe of a well-known American make, and they turned up the centers according to their own ideas. They made them so very blunt that there was little holding power in them, and to make matters worse they simply pounded an old center into the end of the axles and called that centering them, instead of making good centers in them, as we do and as is known to be necessary where heavy cuts are to be taken. The result was, very naturally, that with all the force they could bring to bear on the tailstock hand-wheel, assisted by such brutal devices as levers inserted between its arms they could not bring up the tail center tight enough to hold the work, and from this simple cause they failed with the machine and complained that they had been cheated.

Similar things happened with milling machines. The milling cutters made by the native tool makers (God save the mark) could not by any possibility cut anything, and then when these abortions were put into the machine and it very properly refused to mill, the machine was blamed, and a good deal of trouble was experienced in getting them to try better cutters.

In another case an American boring and turning mill was installed. Soon after it arrived there was a complaint of trouble with it, and upon going to the shop to see what was the matter our friend judged from the behavior of the machine that the worm and wheel by which the table was driven had not been oiled. The workmen insisted that they had oiled the machine all over, and the proprietor and his "engineers" simply knew nothing about it more than was told them by the workmen, and took precious little pains to find out anything. Finally, being unable to satisfy himself in any other way, the American took off his coat and got down into the pit to make the necessary examination. He found, as he expected, that the worm and wheel were entirely dry, oiled them and started the machine off, somewhat the worse for the ignorant abuse it had received, but still in fair working condition. The astonishment of those who witnessed this was not so much at the fact that he was able to divine the cause of the trouble and remedy it, as that he should do it in that manner. The spectacle of a man, evidently not a mere workman, but with the manner, bearing and attire of a gentleman, getting down into a pit to examine the interior of a boring mill and actually touching parts of it and handling such things as wrenches and oil cans was an incomprehensible phenomenon to them, and they could not understand it. They looked at each other as though to say what next will these Americans be doing, and what a strange land it must be from which they come.

The incident shows how the social question is bound up with mechanical progress and achievements, and that our workmen must sink a great deal in the social scale or those of foreign countries rise a great deal before competition can take place on nearly equal terms.

The Cleveland Oil Swindle.

The Gage Tool Company, of Vineland, N. J., send us the regular proposition of the Cleveland oil swindlers, coming in this case from the Reliance Oil and Grease Company, and having the usual tale to the effect that they have a small shipment of oil in the vicinity which will be sold at a sacrifice. The Gage Tool Company say that their reliance is very slight in these companies, and that they now have on hand a can of oil from a Cleveland company sent to them without orders. They asked to be told what to do with it and were not advised, but finally received a bill for the oil, with threat of suit, and to put the matter into the hands of a collecting agency, etc., unless the bill was paid. But finally the grease was sent for, and the Gage Company proposed to charge storage for it, which caused further trouble, and they still hold the can. We have reason to believe that these gentry keep clear of those whom they suppose read the "American Machinist," but they, of course, cannot know in each case, and sometimes are deceived. The Reliance Oil and Grease Company have been in correspondence with John Bertram & Sons, of Dundas, Canada, who are the leading Canadian tool builders, and they led the oil men into a correspondence to see what would come of it, and then sent the letters to us. They could not be trapped into stating just where the oil was, but it had been shipped to a party afterwards found to be of doubtful financial standing. This is a peculiarity of the Reliance Oil and Grease concern's method of doing business. We have numerous letters from them that show that it is their practice to ship oil first and look up the financial standing of their customer afterward, which would be very queer if there were any truth in the tale.

We are informed that the Garvin Machine Company, of New York, has not acquired possession of the William H. Warren Machine Tool Works, of Worcester, as was stated in our issue of January 4, but that the works have been purchased by Mr. Rudolph Kirschbaum, who is the manager of the Deutsche Garvin-Maschinenfabrik, Aktiengesellschaft, of Berlin.

Commercial Review.

NEW YORK, SATURDAY EVENING,
January 13, 1900.

THE ENGINE MARKET AND KINDRED TOPICS.

The new year is settling down to business with the activity of the old practically unabated. In several cases demand is reported rather to be growing than falling off, but this can hardly be taken to prove that the total volume of current orders booked in the market is in excess of those taken last year, when the shops suddenly became congested with work. The situation may be judged to some extent from deliveries, and as these are not, on the average, growing longer, it is to be inferred that demand is not quite as heavy as when deliveries lengthened to their present proportions. Yet facilities have been more or less increased in the meantime, and raw materials, the scarcity of which was formerly a great hindrance, are now easier to obtain. There is much irregularity in deliveries. To say that they are becoming longer on large engines and shorter on small ones, would be to come somewhere near the truth, yet it would be more exact to say that while there is a little easing off among the rank and file of the manufacturers, a few of the prominent ones are more hopelessly crowded than ever. A 1,000 horse-power engine may be had in six months, or probably less in some quarters, yet more than one company could be cited by name which cannot accept a contract for delivery before December, except in special cases. While prices of engines are stationary, as a rule, there are some few advances to give intenser color to the market. Boiler plates are easier; it is asserted that they may be had for distant future shipments at a concession.

As an intelligent summary of market conditions are offered the following opinions given by a spokesman for one of the most prominent engine and engineering firms:

"The demand for engines that comes to us is as good as it has been in the past. Machinery is probably destined to reach still higher prices than those already attained. It has not yet had its full share in the prosperity so far as margins of advance are concerned. Raw products are not so likely to advance further, yet there is no reason to expect an early and important falling off. In spite of the excessive increases of quotations on these lines, iron and steel men have not made the money they are supposed to have made, because they have to a large extent been working to fill unexpired contracts at old prices. At the same time they were shipping some iron at old prices and some at new. I know of an actual case where a manufacturer was melting contemporaneously pig iron which cost him $10 a ton and iron of the same grade which cost him $25 a ton. The reason for such a state of affairs is that the old contracts with the furnaceman called for a certain quantity of iron a month and the unforeseen demand for finished products necessitated the melting of an extra quantity of pig, which consequently had to be bought in the market at current prices. As a matter of fact, more was obtained at some intermediate price, such as $22 or $23, than at $25. The contracts which manufacturers had outstanding on the old basis have now expired, or will expire very soon.

"Machinery manufacturers as well as iron and steel producers were to a great extent working at old prices in 1899. For everyone the volume of business was good, but not in all cases were profits adequate. With costs evened up and old contracts out of the way, the prospects are that 1900, although it may see no greater volume of business, nor even quite as large, will be a better year financially than 1899.

"Probably there will be a little fall in iron and steel before the end of the year. Last November saw the highest prices, I think. Moderate reductions in price will bring into the market a great deal of work that is now being held up because figures are too steep, and this will check any pronounced downward movement. While the market may break in sections, there will be no general collapse."

The fact that American manufacturers are overreaching themselves in the matter of prices so far as export trade is concerned is exemplified in connection with a large electrical power installation for which American and foreign manufacturers are now submitting competitive bids. From the circumstances of the case there is little question that American material would have had a walkover a year ago, but as things now stand we are informed that the American engine manufacturers have only a moderate chance of success, while it is extremely unlikely that American electrical machinery will be accepted.

Reference has frequently been made here to the present boom in the cement industry. One manufacturer of pulverizing machinery, which is used in that class of work, speaks in most glowing terms of the demand for the product of his shop. He has been shipping machines for mills from Canada to the Gulf States, and the demand continues unabated, the shop being several months behindhand with orders. The cause of this boom in the cement industry, he says, is the employment of that substance in building operations where formerly other materials were used; for instance, foundations made of a concrete containing cement are used in place of stone. Moreover, a couple of years ago the greater part of the Portland cement used in America was imported. The supply of cement has not yet caught up with the demand, though at the rate new mills are going up there is liable to be an overproduction in course of time. There is some demand for machine tools in connection with cement manufacture, since many mills have their own repair shops. This is the more necessary from the fact that they frequently are situated in regions remote from other machine shops.

The plant and property of the Stanley Electric Manufacturing Company, Pittsfield, Mass., has been purchased by the John A. Roebling's Sons Company, and has been reincorporated at Trenton, N. J., as a new concern, with a capital of $2,000,000. The stock has been underwritten by interests connected with the Roebling company. It is the intention that the new Stanley Electric Manufacturing Company shall manufacture electrical machinery as did the old, and it will probably be operated under the same management as the Roebling company.

The Joseph Dixon Crucible Company, Jersey City, N. J., which is erecting a new building, 125x40 feet, four stories high, has ordered through Woolston & Brew, 141 Broadway, New York, a 150 horse-power Fischer four-valve engine, and has contracted with the Crocker-Wheeler Company to furnish generators and motors for lighting and power.

Woolston & Brew are now installing in the Long Island City works of the Standard Oil Company two 225 and one 150 horse-power Fischer engines, direct-connected to Westinghouse alternators. The current is to be applied to power purposes, and the installation, which is an innovation in its way, is of particular interest, since the Standard Oil Company expects to give it a year's exhaustive trial with a view to the equipment of their other plants with electric power distribution if the results are satisfactory.

Mr. J. F. Rogers, one of the best known *ante-bellum* exporters of machinery and supplies from this city to Cuba, informs us that the Cuban market shows signs of improvement. He has taken very good orders lately. These are for the equipment of manufacturing establishments rather than of plantations. Among the sales were three engines and three boilers, with shafting, pulleys, belts, etc., for different factories. Conditions on the island are still waiting more or less earnestly upon the settlement of its political destiny. General Wood's assumption of control will have a salutary effect, it is thought, and its results in a business way seem even now to be perceptible.

Last Wednesday week J. F. Rogers & Co. shipped twenty wood-working machines to Guayaquil, Ecuador, for furniture and planing-mill equipment. Proposals have been submitted for furnishing an electric lighting plant for the city of Guayaquil. The outfit will include three large engines with dynamos. The chief engineer of the enterprise has been in this country and inspected various electric lighting apparatus in company with Mr. Rogers. Next summer some capitalists interested in the enterprise are expected to

arrive and take action in regard to the contracts.

The Acme Road Machinery Company (capital $150,000) was incorporated at Albany, N. Y., January 8. Philander Pollock, of Troy, is president; Julian Scholl, vice-president; Walter A. Cook, Jr., general manager; James W. Jones, secretary and treasurer, and Elliott Danforth is one of the directors. The company has leased for ninety-nine years shops in Frankfort, N. Y., formerly occupied by the West Shore Railroad. The works will be equipped with new machinery to the value of $50,000 or $75,000, the greater part of which is already purchased. Mr. Scholl, the vice-president, is of Julian Scholl & Co., New York, who formerly were agents for the Weston Engine Company, and still represent the Climax Road Machine Company, with the latter of which other leading men of the new concern have been connected. He states that the equipment of the Acme shop is being attended to from the Frankfort office, but that it naturally will include such tools as lathes, boring mills, punches, drills, shears, also, perhaps, foundry machinery.

The Northern Pacific Railroad has ordered ten 35 horse-power Westinghouse standard engines for direct connection to Westinghouse generators. It is believed that they will be used for train lighting.

The Harrisburg Foundry and Machine Company has sold three 90 horse-power "Standard" engines for a tall new building which is going up on Nineteenth street and Fourth avenue, New York.

J. G. White & Co. have taken the contract to equip the Toledo (Ohio) & Monroe Beach Electric Railway, which will afford transit at a phenomenally high speed for a trolley road. Outside of cities the average rate, including stops, is to be thirty miles an hour, though the cars are to be equipped to run at a maximum speed of fifty miles. The first machinery installment will comprise two 400-kilowatt alternating-current generators, with transformers and rotary converter equipment. The engines will be of the cross-compound type, and the boilers water-tube, adapted to carry 160 pounds working pressure.

Here is an incident which goes to show that the large stocks of tools offered for sale by certain dealers may be partly made up to bluff. A firm have lately been offering among their big assortment between two and three dozen of a certain type of machine made by a particular manufacturer. From stocks of that tool held by the manufacturing company a year ago as compared with those at present, and from the orders on their books, it is said to be rendered practically certain that not only did the selling firm not have the tools in stock at the time they claimed to, but that they had not even placed orders for the machines.

There have been several complaints of a tapering off of export trade in machine tools. One such opinion is that of as good an authority upon the foreign market as we know. Among the causes cited to account for it in part is this: That when deliveries were longest buyers had to get their orders booked or wait an absurdly long time for the tools, but that now tools are more readily obtained and buyers do not feel the necessity of haste. Another authority whose operations on the Continent are centered in a neighboring territory to that of the former, states that inquiries have never been so numerous as now. He says, however, that large valuations of orders have been lost by the higher prices. His firm has shipments of tools for the Transvaal amounting to thousands of dollars held up by the war. He does not find deliveries, except upon some small tools, any easier than they have been. Six months is the average on orders now outstanding, and for some that he has placed he is waiting a year.

A man who travels much among shipyards for a line akin to machine tools says shipbuilders are finding business conditions so propitious that they say that at the very worst they will have all they can do to keep them busy for the next ten years.

CHICAGO MACHINERY MARKET.

Sellers of power are permeated with the impression that the year 1900 is to be one of unexampled fullness of trade for them. Two or three, when asked for the basis of their sanguine attitude, replied in about this wise: Until last year very few manufacturing companies had modernized their power. There had been a period of about six years during which shop expenses were minimized. In 1899 considerable progress was made, but many producers held back until after they had made a little money. That happy result has now been attained, and the times are ripe for extensive overhaulings of power. A plant which is seven or eight years old is more or less out of date and not in a position to do the best work. There is, therefore, a vast amount of improvement in sight. Consolidations have stimulated this impulse towards rejuvenation. The unionizing of the various electric and lighting companies in Kansas City, for example, has enabled the new ownership to discard old and partially worn out machinery for a strictly modern and efficient equipment. Another way in which consolidations of medium sized plants throughout the country into one ownership have resulted beneficially for the engine and boiler trade is that these corporations employ a high grade of engineering ability and that as a consequence antiquated power makes a much speedier exit from activity than if the less critical individual ownership had remained in control. This stimulus towards the latest and best naturally affects to the greatest degree the best types of power, and not only them, but the various modern accessories, which are now recognized as factors of the best economy.

The things actually accomplished by sellers of power during the first two weeks of January have not been especially notable. Trade during December kept up in a rather remarkable way almost to the last day of the year. The new buying movement has not yet gained its expected velocity or volume, but inquiries are appearing in a most encouraging manner. A considerable portion is for new plants. Electric street railways hold prominence, but various factories are insistently present. Cement works are one of the popular avenues for industrial investment. Product is not at all adequate to current demands.

Willis Shaw says the demand for hoisting engines is very active. The inquiry comes from all mining regions. The demand for improved machinery for excavations and similar engineering work was never so keen.

Quite a little second-hand power is coming on the market as the result of the revolution in progress, but it finds quick sale, buyers taking it largely because they thereby secure more favorable deliveries.

Quotations.

NEW YORK, Monday, January 15, 1900.

Iron—American Pig, tidewater delivery—

Pennsylvania Irons:

No. 1 X foundry	$24 20 @ $24 70
No. 2 X foundry	23 20 @ 23 70
No. 2 plain	22 20 @ 22 70

Alabama Irons:

No. 1 foundry	22 75 @ 23 00
No. 2 foundry	21 75 @ 22 00
No. 3 foundry	20 50 @ 21 25
No. 1 soft	22 75 @ 23 00
No. 2 soft	21 75 @ 22 00
Foundry forge	20 25 @ 20 50

Bar Iron — Base sizes — Refined, mill price on dock, 2.20 @ 2.30c.; store price, 2.55 @ 2.60c.; common from store, 2.50c.

Tool Steel—Base sizes—Standard quality, 7 @ 8c.; extra grades, 12 @ 14c.; special grades, 16c. and upward.

Machinery Steel—Base sizes—Ordinary brands from store, 2.90 @ 3¼c.

Cold Rolled Steel Shafting—Base sizes—From store, 4 @ 4¼c.

Copper—Lake Superior ingot, 16⅜ @ 16⅝c.; electrolytic, 16 @ 16¼c.; casting copper, 15⅞ @ 16c.

Pig Lead—Wholesale lots, 4.70 @ 4.75c., New York delivery; carloads, 4.75 @ 4.80c.

Pig Tin—In 5 and 10-ton lots, f. o. b., New York, 27¾ @ 28¼c.

Spelter—Prime Western, 4.50 @ 4.60c., New York delivery.

Antimony—Cookson's, 11c. average; Hallett's, 9¾c.

Lard Oil—Prime City, present make, 48 @ 52c. in jobbing lots, according to brand and quantity.

Multiple Spindle Automatic Screw Machine.

The automatic screw machine ranks among the great achievements of the human mind. Like many great advances in productive methods, its advent was followed by a pause in improvement other than minor ones of detail. This pause during the past few years has, however, been broken, and the machine which we have the privilege of showing herewith marks the introduction of a new principle into this class of machinery.

The standard form of automatic screw machine is essentially a turret lathe, with means for automatically operating the turret and for feeding the stock. Each tool does its work in turn, a single tool only operating at a time. The essential feature in the present machine is the provision whereby all the tools act simultaneously. Four bars of stock are acted upon and four pieces are being operated upon at the same time. Instead of the tool support revolving to bring the tools to position in succession, the tools are stationary in position, except as regards the feed, the bars of stock being carried by a revolving cage or cylinder, which revolves to bring the bars before the tools. All four bars face one or other of the tools in succession, and all are acted upon at the same time. Tracing the action through, when a given bar is having the second operation performed upon it, a bar behind it is having the first operation performed. When the first bar reaches the third position, the bar behind it is in the second position and a second bar behind it is in the first position. When the first bar reaches the fourth position it has three behind it, upon which the third, second and first operations, respectively, are being performed. Thus, after the first piece has reached the fourth position, the machine contains at the same time a piece in all stages of completion, and each movement sees a piece completed and cut off. In point of fact, two operations are often done in each position, such operations as shouldering, forming, knurling, etc., which are done by side acting tools, being performed at the same time that drilling, reaming or threading are being done by centrally acting ones.

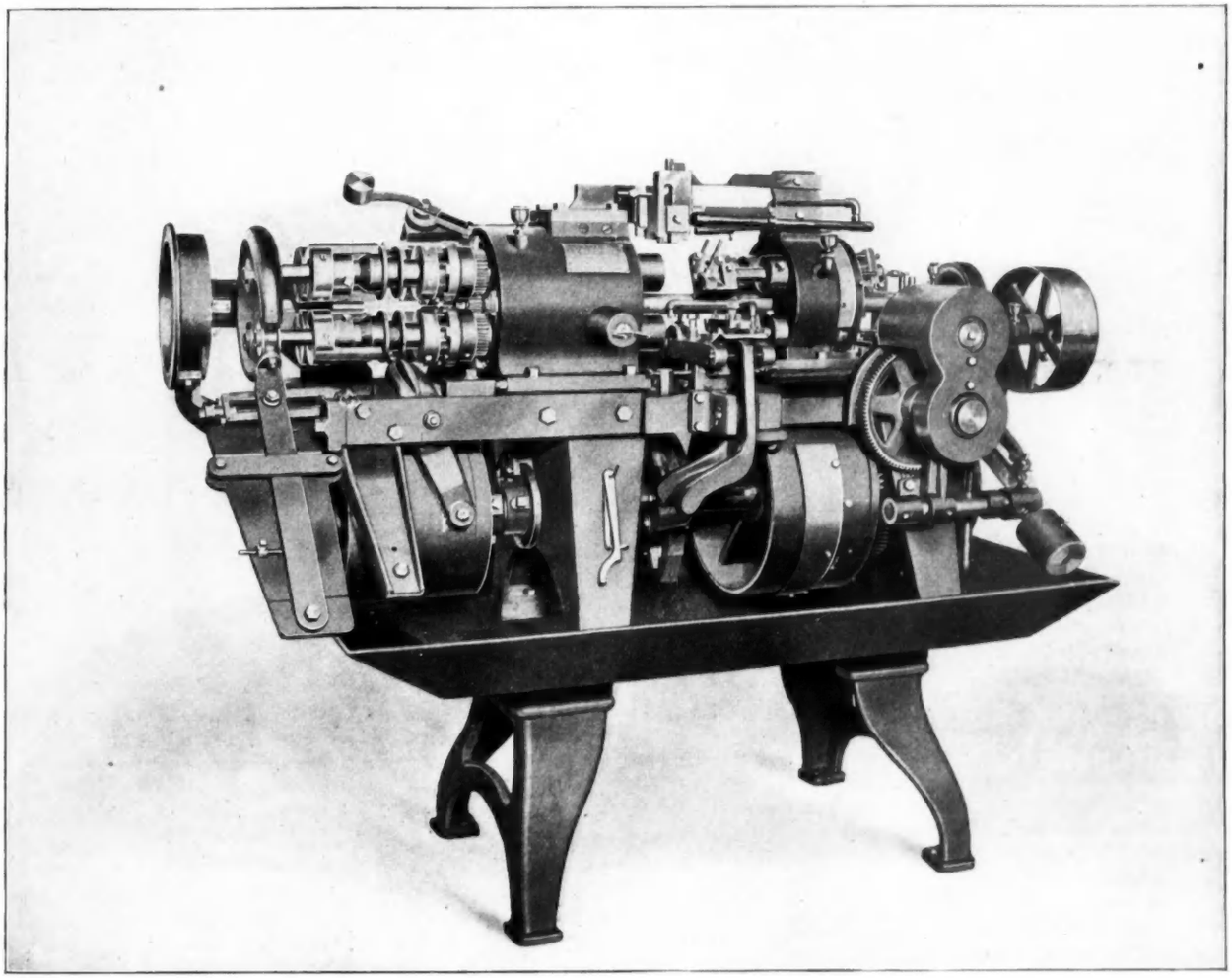


FIG. 1. FRONT VIEW OF ACME AUTOMATIC SCREW MACHINE.

Referring to the illustrations, Fig. 1 shows the complete machine from the operator's side. The four spindles for carrying as many bars of stock, with the toggle connections of the collet chucks, will be seen at the left. A bar of stock being inserted in each spindle, a revolving lantern of pipe, arranged as shown in Fig. 2, which is from the rear side of the machine, supports the bars and prevents whipping and tangling. The work spindles are carried by a head occupying the position of a lathe head, and the tool spindles are carried by a knee at the right, which reciprocates in ways on the shears in the manner of a turret slide, and thus accomplishes the feed. Both these heads are shown in detail further on. The main driving shaft is driven from the right, Fig. 1, and extends through both head and knee in the center line thereof. By means of master gears it may drive either work spindles or tool spindles. The work spindle driving gears are in plain sight at the left of the work spindle head in Fig. 1. They are not, however, mounted directly upon the spindles, but upon spring collets, which embrace the spindles, and by tightening or releasing the collets the spindles may be driven or not, as desired, and it should be said here that the work may be done by turning the work spindles, the tool spindles, or both, as desired. The work

spindle may, and usually does, rotate in some positions and stand still in others. The operation of the spindle collet chuck is automatic through the cam drum below, and each spindle is thus made to rotate or stop rotating as it arrives in each position, in accordance with the adjustment of the proper cam. The knee which carries the tool spindles does not rotate, and it will thus be seen that in this machine the fundamental feature of all other screw machines, whether plain or automatic—the turret—is abandoned.

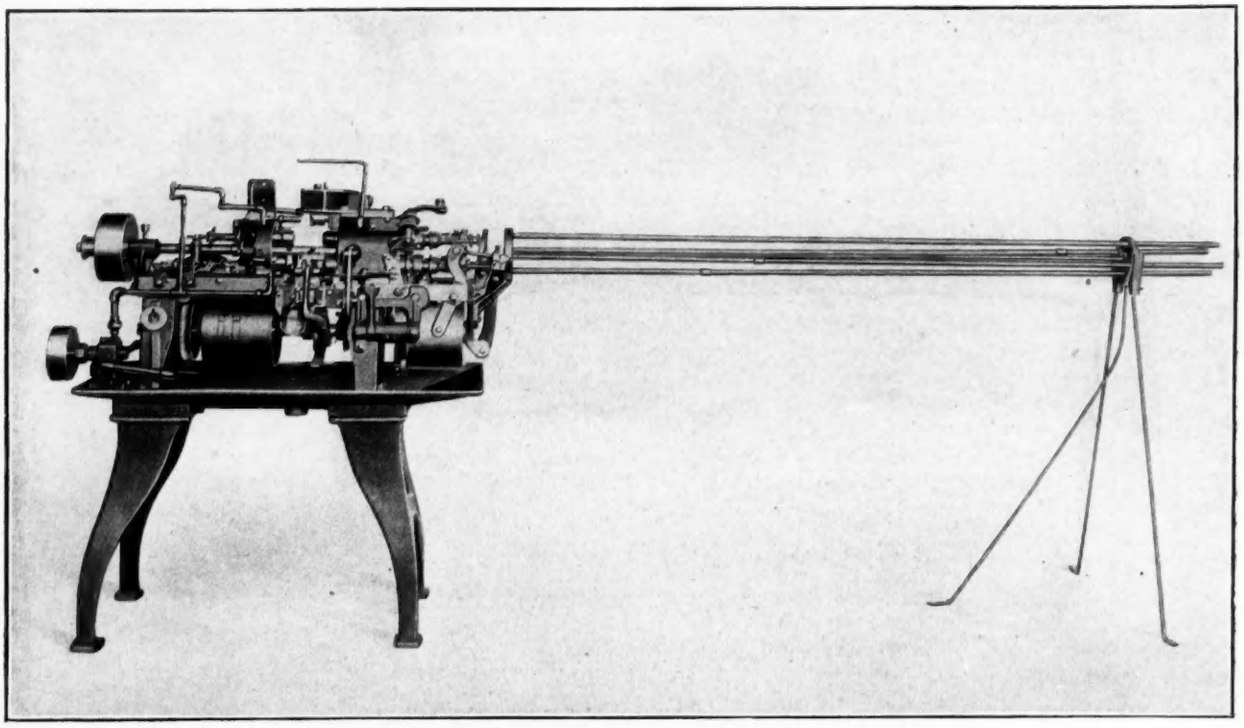


FIG. 2. REAR VIEW OF ACME AUTOMATIC SCREW MACHINE, SHOWING LANTERN OF PIPE FOR CARRYING BARS OF STOCK.

The cam shaft occupies the usual position and carries the usual cam drums. The right-hand drum of Fig. 1 operates the feed motion of the tools, and the drum at the left operates the wire feed and chucks, as well as the chucks which determine whether or no the work spindle shall rotate. All cams on this drum are fixtures and require no change of any nature for whatever work can be performed on the machine, a screw adjustment serving to regulate the various lengths to be fed.

Three cross slides for shouldering, knurling, or cutting off are also provided. Two of these are mounted in the usual manner on the front and rear shears, respectively, and are operated by a third cam drum, or, more properly speaking, disk, placed between the other two. The third tool slide is placed upon a bridge supported by the work spindle head and the tool spindle knee, the tool being operated by a sliding cam bar carried by the knee. The cam shaft also carries a segment gear, not seen in the illustrations, but located between the left-hand drum and legs. This segment meshes with teeth cut upon a sector gear upon the cam shaft turns the cylinder will be seen at the right. Two of the four index notches will also be seen. These notches are based upon essentially the same principle as the standard Pratt & Whitney turret index notches. The index gear engages and the cylinder rotates, the front side of the cylinder, as located in Fig. 3, moves downward, and the beveled edge of the notch pushes the pin backward as a door latch is pushed backward when the door is closed. As the next notch is

Fig. 3 shows the work spindle cylinder removed from the head, with one of the spindles in place, the cylinder being turned end for end from the position when in place in Fig. 1. The teeth by which the cylinder which carries the work spindles, and which rotates within the head—the center of motion being the center of the driving shaft. The engagement is made once for each rotation of the cam shaft and each engagement turns the cylinder through a quarter of a revolution.

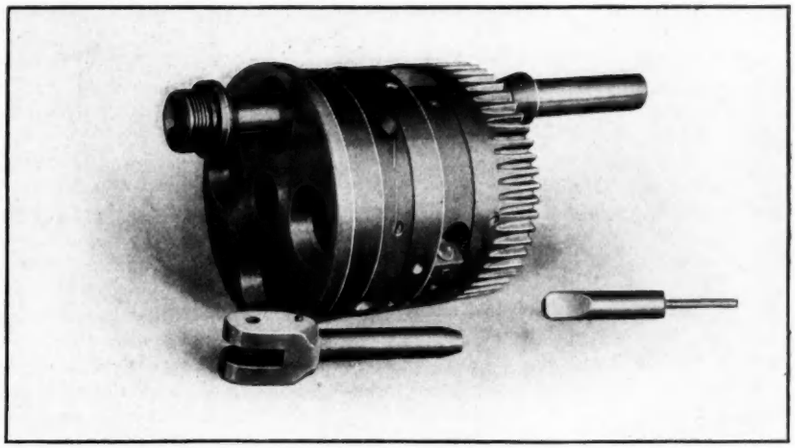


FIG. 3. WORK SPINDLE CYLINDER.

dexing edge is radial and bears upon a movable pin having a corresponding face radial to the cylinder, which pin is included in the pictures below and to the right in Fig. 3, and in place in its boss near the bottom of the head in Fig. 1. The acting radial face of the notch has a hardened steel plug inserted, as is plainly shown in Fig. 3, and the pin is also hardened. The other side of the notch is beveled, and the pin is free to slide endwise, being backed up by a spring. As the sec-

reached the pin snaps into it, but the sector gear carries the motion a little too far. As the gears disengage, the taper-ended pin seen below and to the left of Fig. 3, but located on the rear side of the machine, is pushed into one of the second set of oblong notches, also shown in Fig. 3, and the taper end acting upon the taper side of its notch revolves the cylinder slightly backward until the radial side of the index notch engages positively with the index plug. The radial index surfaces never slide upon one another, being only tightened and loosened when in contact, and, of course, there can be no appreciable wear to destroy accuracy, yet to guard against any contingency of this nature a compensating adjustment is provided. As positive and continued alignment of work spindles and tool spindles is essential, this feature will be seen to be of prime importance.

Figs. 4 and 5 show front and rear views, respectively, of the tool spindle knee, the manner in which the spindles are geared to the central shaft being clearly shown. They are, however, connected to the gears by collet chucks in such manner that the connection may be broken at will and the spindle be held stationary, if desired. The work and tool spindles are driven at different speeds, and, without changing a gear, three effective speeds are thus always available for each tool, namely, that of the work spindle with the tool spindle standing still, that of the tool spindle with the work spindle standing still, and the sum of the two due to both spindles revolving together. One of the tool spindles—the upper right-hand one of Fig. 5—is also fitted with back gears, as shown, which may or may not be used, as desired. This spindle is ordinarily used for threading or tapping, and the slow speed is intended especially for those operations in order to prolong the life of the taps or dies. Another special feature of the threading spindle is a finger in its rear, which moves up at the engagement of the tap or die and gives it a positive push into the work, thereby insuring a clean start without danger of any imperfect threads. The threading operation is one of the most interesting of the entire machine, due, in addition to this feature, to the fact that the threading tool does not reverse in withdrawing from the work. In threading, the tool spindle rotates slowly through the back gears, but at the completion of the operation, instead of reversing, it runs on, though the tap or die stops from the disengagement of the usual clutch jaws. Following this, the work spindle starts into rapid motion and runs the work off the tool—the running on being done with one spindle and the running off with the other. It thus comes about that no crossed belts are used about the machine, and no reversal of motion of any rotating part is needed for any operation. It may be said also that the principal motions are all positive in both directions. No springs are used for any reverse motion, the cams acting in both directions.

While the leading feature of the machine is the performance of so many operations simultaneously, it is not the only

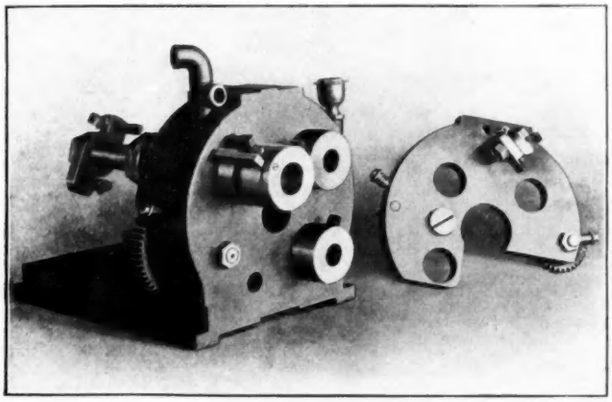


FIG. 4. FRONT SIDE OF TOOL SPINDLE KNEE.

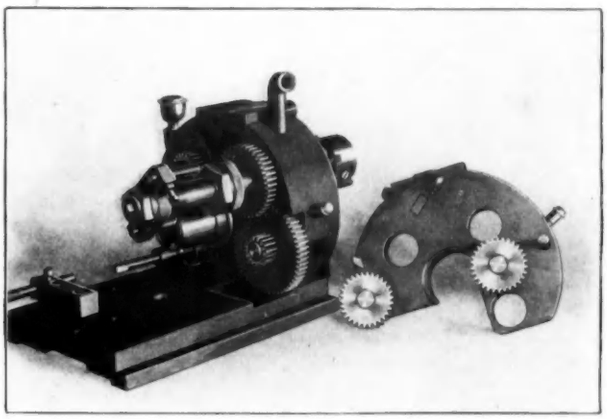


FIG. 5. REAR SIDE OF TOOL SPINDLE KNEE, WITH COVER PLATE REMOVED.

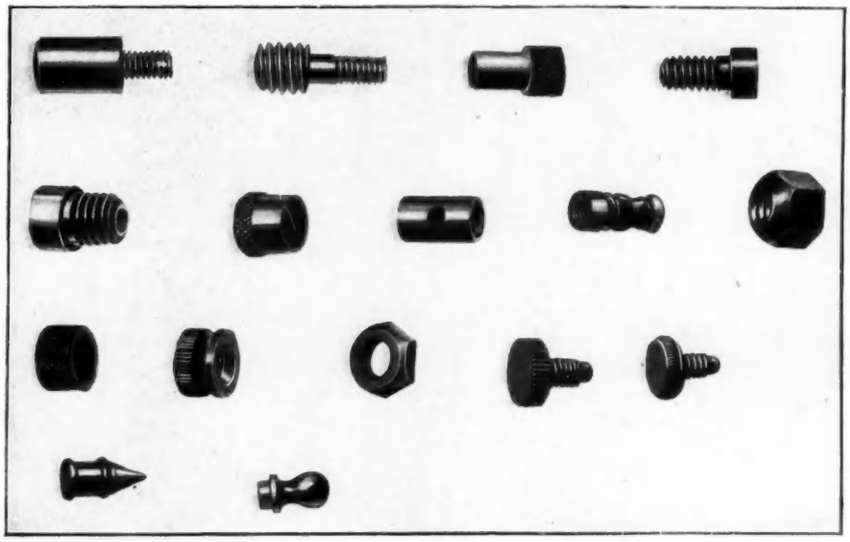


FIG. 6. BRASS PIECES PRODUCED AT THE RATE OF 6,000 TO 7,000 PER DAY.

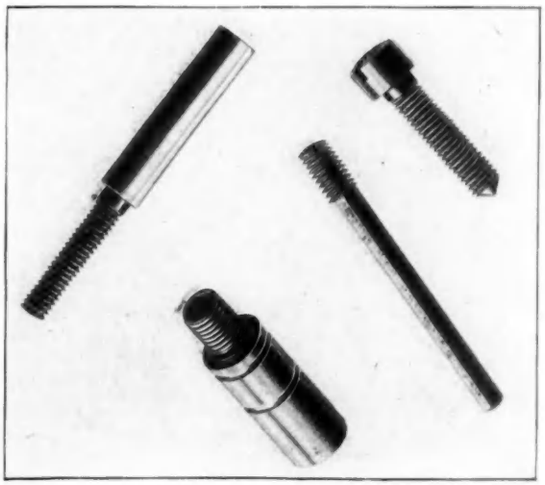


FIG. 7. BRASS PIECES PRODUCED AT THE RATE OF 3,000 PER DAY

one, although others grow out of it. Thus all operations being done together, the total time required is that necessary for the longest single operation, and this means that all the others can be done in a very leisurely manner. There is no occasion to hurry any operation in order to increase the output, except the longest one. Threading can thus be done slowly, as already described, and such operations as cutting off, on which the appearance of the work often in large degree depends, may also be done at a rate of feed that insures a first-class appearance.

Increased automatic action in any machine is usually accompanied by an increase in the amount of preparation necessary for doing a given piece of work with a corresponding increase in the "setting up" time, but in this machine we have a curious reversal of this condition. Since the tools are all fed to the work simultaneously, it follows that but one cam is required for the feed drum and but one cam need be made for each new job. The speed of the machine is varied by changing the driving pulley, and it thus comes about that, in addition to the actual tools, it is usually necessary to provide one cam only for the feed drum and to select a suitable pulley to give the proper speed for the size of the work to be done.

As the object of such a machine is to do rapid work, we give in Figs. 6, 7, 8 and 9 some illustrations, full size, of a considerable number of pieces, with the actual output per day of ten hours—all delays for changing stock, sharpening tools, etc., being accounted for in the figures given. Referring to Fig. 8, the little headless steel screw shown has been made in quantities running into the millions, and on one machine the output for a period of over sixty days consecutive running averaged 9,400 per day. Another remarkable exhibit is that of Fig. 9. For the making of these brass pieces there was no money consideration. The purchaser sent his stock to the factory and received back his screws, leaving only the *chips* behind as payment for doing the work.

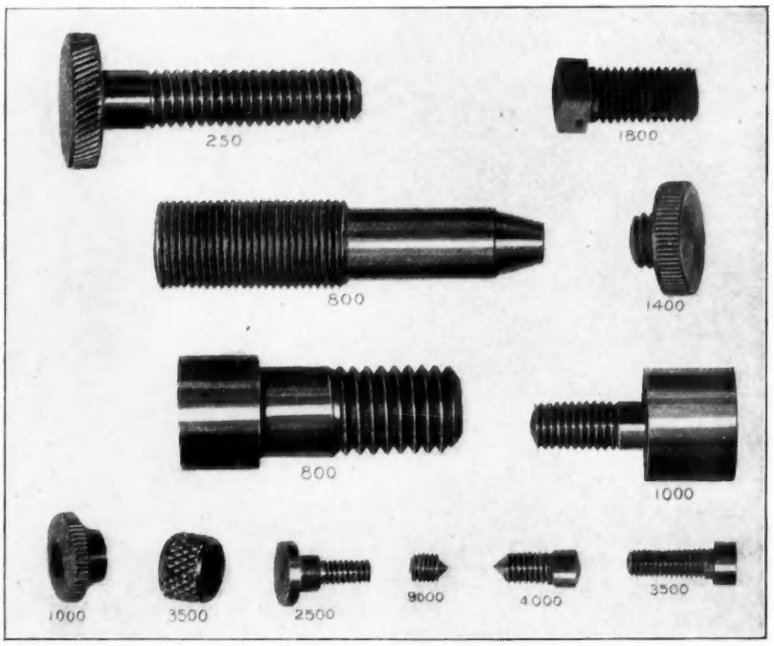


FIG. 8. STEEL PIECES PRODUCED AT THE RATE PER DAY NOTED OPPOSITE EACH ONE.

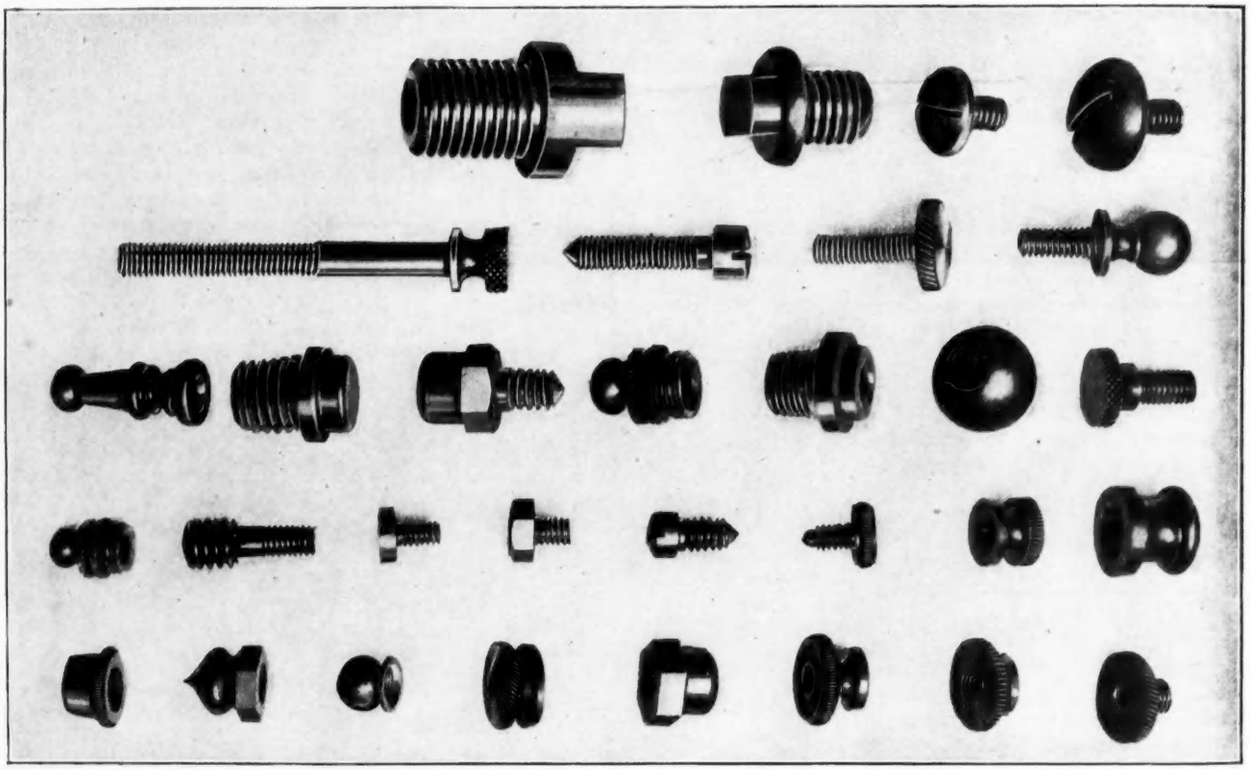


FIG. 9. BRASS PIECES FOR WHICH THE CHIPS CUT OFF WERE TAKEN AS PAY FOR DOING THE WORK.

The machine described is the product of the Acme Machine Screw Company, of Hartford, Conn.

The New Drawing Office of the Schenectady Locomotive Works.

The accompanying half-tone and line engravings represent a new drawing office which has been completed recently by the Schenectady Locomotive Works. It represents all that is best in drawing-office facilities, and is in fact one of the finest, if not the finest, apartment for that purpose which we have ever seen.

The new room is on the second floor of the office building of the works and opens from the old drawing office by a wide opening without doors. The opening into the old office is shown in the background of Fig. 1. The provision for lighting will be seen to be very superior. The room is very high and the windows are about as numerous and as high as structural considerations would permit. The side of the room in the rear of the camera is also filled with windows like those shown, the sides thus lighted being the east, south and west fronts, north light being impossible from the location of the old building. To the man who has been educated to the virtues of north light, the location might seem to be unfavorable, but the problem was solved by the use of ribbed glass for the windows. The virtues of this glass are gradually becoming understood, and a room lighted through it, like this one, has only to be seen to make those virtues plain to anyone, no matter how skeptical he may be. The room is filled with a soft, diffused light in every part, and there is practically no choice of location, so far as light is concerned. Those who look at the glass, rather than at its effect, sometimes criticise it as being, in effect, frosted glass which softens the light by stopping some of it, but those who have given the subject attention know that the effect of ribbed glass is entirely different. Objects cannot be seen through it, because it breaks up the light from them as it does the direct rays of the sun, but it does not stop the light. On the contrary, instead of allowing a sunbeam to fall directly in one spot where it is not wanted, it diffuses it in all directions, and thus throws it where it is wanted. A good deal of this glass is used on the sunny sides of the shop buildings of these works, and before adopting it Mr. Sague made a conclusive experiment, which demonstrated its action to be as described. He placed a piece of this glass and one of common glass over the opening of a photographic dark room and then took photographs of objects within the room, and the result was conclusive. No light was stopped by it, but, on the contrary, under some conditions it seemed to actually bring more light into the room than the plain glass. With the ribs outside, this effect is entirely rational, as the ribs would then serve to gather light from directions which the plain glass would not. It should be said, however, that with bright sunlight shining on a given window, the diffusive effect of the ribbed glass is not sufficient to reduce the light to a point where work directly in front of the window is agreeable, and two shades, wound upon rollers at the meeting point of the sash, are provided for each window.

FIG. 1. INTERIOR VIEW OF THE SCHENECTADY LOCOMOTIVE WORKS DRAWING OFFICE.

For artificial lighting arc lamps are employed, on the plan used at the Armour Institute and described by Mr. G. F. Gebhardt in our issue of November 9 last. A similar plan, but using incandescent instead of arc lamps was described and illustrated in our issue of January 14, 1897, as

in use in the drawing office of the Lane & Bodley Company. In the present instance the lamps are of the General Electric Company's make, and to the courtesy of that company we are indebted for the photograph from which the half-tone was made. The lamps burn upside down, so far as the direction of the current is concerned, this arrangement being adopted because by it the greater portion of the light is thrown upward toward the ceiling instead of downward, as usual. They are connected to the incandescent circuit, are of the slow-burning, enclosed-arc type, and below each one is an opal shade which softens such rays as would otherwise come direct from the arc. The ceiling and walls of the room are painted white, with a slight tinge of green, and it is the reflected light from the walls and ceiling which mainly lights the tables. The artificial lighting is just as successful as the day lighting. In fact, we have never seen a drawing room, after nightfall, in which there was such an absence of shadows. As during the daytime, the room is filled with a soft, diffused light coming from all directions, in which it is a delight to work. There can be no doubt that this is the best method of artificially lighting a drawing office yet devised.

The heating is by the fan blast system, for which the flues are built into the walls of the building, and two of the outlets are shown in the wall between the windows.

A general plan of the room with the layout of the tables is given in Fig. 2, the drawing of which was kindly made for us by the locomotive works. The tables will be seen to be very large, and so located with respect to the windows as to obtain the full benefit of the light. The small circles represent the draftsmen, who will be seen to be arranged in groups of four, each group occupying not an entire table, but the adjacent sides of two tables. Thus the four men *a, b, c, d* constitute a group. Of these *a* is a leading draftsman in charge of a job, and *b, c, d* are his assistants. Leader *a* has the entire half of a table appropriated to his use, and his assistants are directly behind him. The leader works up the general drawing of the engine in his charge, and from this general drawing his assistants work up the details. The general drawing is on a large sheet of, we should judge, about 6 feet in length, while the detail drawings are, of course, of convenient shop size. The methods of the leader are quite different from those usually employed, especially in that he uses no drawing board, thumb tacks or T-square. The general drawings are made on the finest quality of canvas-backed paper, which is heavy enough to lie flat without thumb tacks or glue, and in fact it is laid directly on the hard wood surface of the table. The size of the sheet precludes the use of a T-square, both from the difficulty of reaching its head and from the flexibility of the blade. The draftsman begins his work by laying down at the bottom of the sheet a permanent base or reference line, and from this the boiler, cylinder and other center lines are laid out by compasses. Vertical center lines of the stack, dome, etc., are likewise laid out, either by the compasses or by the use of two triangles. The general drawing occupies two sheets, one containing the elevations—no plan of the entire machine is made—and the other the sections. Constant changing from one to the other is of course necessary, and they lie together, one above the other, on the table, and are changed as occasion requires. For such details as are laid down on the general drawing, the horizontal and vertical lines are determined by the use of two triangles exclusively, except that where long lines are required they are laid out by the compasses and drawn in by a long straight-edge. To one who has been raised on the T-square the methods seem strange, but no one can watch a locomotive draftsman at work without concluding that he knows his business and that a T-square is a much less essential feature of a draftsman's outfit than most of us think. The detail drawings are made in the usual way with drawing board and T-square. So far as we know, the newer style of drawing board, with parallel motion straight-edge, has not been tried on this class of work. Whether it would be found suitable to it we will not pretend to say. The tables are fitted with small drawers with lock and key—one for each draftsman, as a place wherein to keep his personal belongings—and with a sliding board alongside, which draws out like a drawer, and is used for holding the instruments in use, the inkwells, etc. Large drawers are also provided, as shown, wherein to keep drawings in hand and those in use for reference, etc. These large drawers have no locks and run on rollers.

We are not sure that a draftsman's work becomes a source of unmixed joy among such surroundings, but there can be no doubt that his efficiency is materially increased by them.

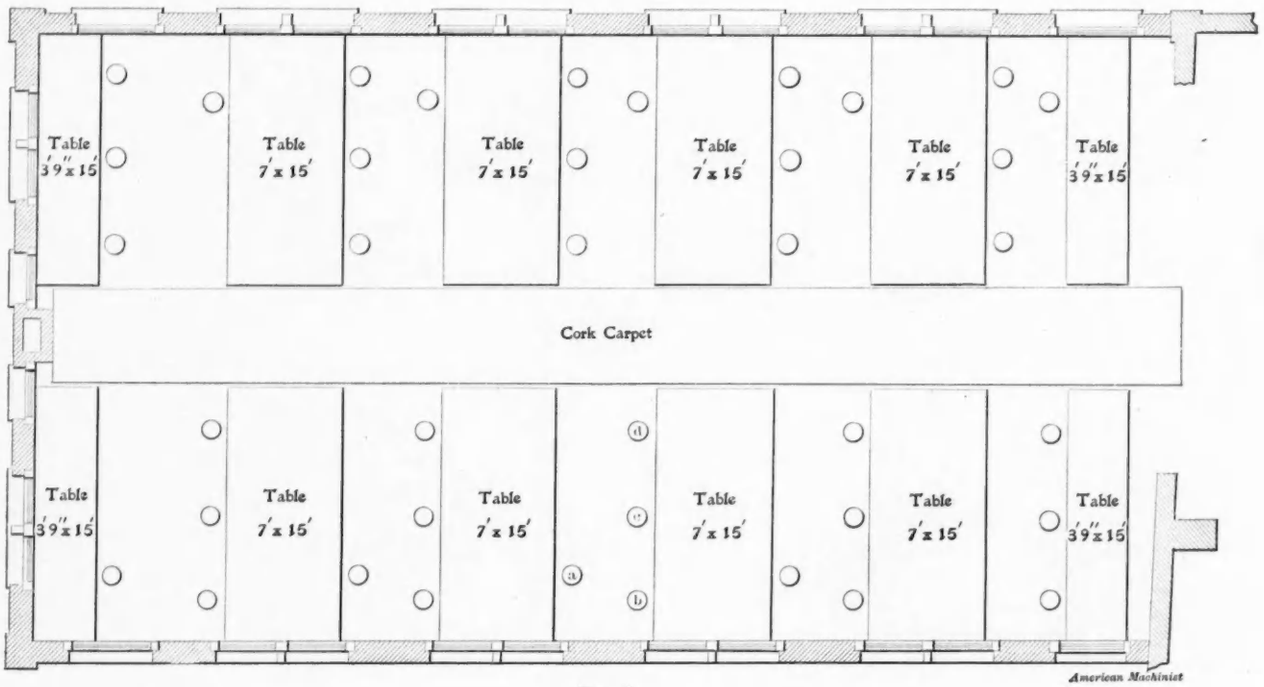


Fig. 2

PLAN OF THE SCHENECTADY LOCOMOTIVE WORKS DRAWING OFFICE. INTERIOR DIMENSIONS, 34 FEET 10 INCHES BY 68 FEET.

A Shop's Dining Room.

There can be no question but that the physical comfort and well-being of men employed in industrial establishments receives an increasing share of attention. It is being more and more generally recognized that the better physical condition of employees conduces to better work and more of it, to say nothing of the fact that a good bodily state conduces to a contented mind and to permanently pleasant relations between employer and employed.

Among the other points now being considered in some places is the noon-day meal, which a large proportion of employees, especially in large cities, must carry with them, to be eaten cold in the shop during the noon-hour, or must go out for to some nearby boarding house or restaurant. The first alternative is not a pleasant one. A cold bite is a poor substitute for the meal which a workingman should have, while the latter is rather expensive.

A SHOP DINING ROOM IN ACTION.

Perceiving these difficulties, the Cleveland Twist Drill Company undertook to remedy them in their factory so far as possible, and an account of how they have done this, and their experience with it, may be helpful to others.

In response to our request, the company gives us the following account of it:

"We were prompted to consider the question of furnishing our employees with a mid-day meal by noticing them eating their cold lunches in odd places around the factory. We felt that, if possible, they should be made more comfortable. After a good deal of thought we arrived at the conclusion that if they could be furnished with a hot, well-cooked and well-served dinner at a small cost, our men would be happier and healthier, and that in so doing we would get better results in increased efficiency.

"Accordingly we fitted up one of the rooms in our new addition as a dining room and kitchen. The dining room contains three long tables, each 82 feet long, and the three will comfortably seat from 260 to 270 men at one time. The tables are covered with white oil-cloth, and each seat is numbered, so that a man occupies the same seat all the time.

"We divide the men into squads of eight, and each squad selects from its number one who acts as monitor or waiter for a term of two weeks, when another takes his place, and so on until at the end of sixteen weeks the first man comes on duty again. Each man is provided with an apron and tray. The apron has three pockets, so that the monitor may keep his meal checks separately. These meal checks are of 1, 2 and 5-cent denominations, and are hard rubber of different colors, so that each denomination may be readily distinguished. The meal checks are kept by the time-keeper, and the men buy them from him in lots of from twenty-five cents' to one dollar's worth at a time. We have a rule to sell not less than twenty-five cents' worth.

"There are three racks hung in different parts of the dining room, where is displayed the menu for the following day, with the price of each article. Before leaving the dining room the men give their monitor their order for the next day's dinner and the necessary checks to pay for it. This order is taken down on a specially prepared card (a sample of which we inclose herewith), and after the order is given the monitor leaves it with the chef. The chef is thus informed as to the quantity of each article to cook for the morrow, so that there may be little or no food lost.

"The monitors assemble in the dining room fifteen minutes before the whistle blows for dinner. There are thirty of them, and the company gives them these fifteen minutes. They form in line, and as they come up to the kitchen counter they call off their order from the card and pay for what they get with the checks as above mentioned. Within the fifteen minutes most of the food is on the table ready for the men when they come in, immediately after the whistle blows, and as there is only half an hour's time at noon, promptness in serving is very necessary.

"In the early part of this letter we should have said that our idea is to charge exactly cost for the food. In figuring the cost we do not include the investment or salaries paid to the chef and his assistants. We propose to donate that amount and our trouble, as well as the loss of time of the monitors in going up to the dining room fifteen minutes ahead of time.

"The kitchen is equipped with a large double-oven hotel range and all the conveniences found in a first-class restaurant kitchen.

"The chef has one permanent assistant, and during the meal time two of the men in the shipping department go into the kitchen to help serve. There is also a storeroom next the kitchen, where is located a large refrigerator and a good stock of supplies. We buy everything in large quantities and give our men the benefit of

the money saved by so doing. We inclose yesterday's menu, with prices attached, which is a fair sample of what is furnished every day. The menu is changed each day, so there may be a variety.

"We are glad to say that our efforts are thoroughly appreciated by the men, and it is now a daily occurrence for mechanics to apply to us for a job, saying that they want to work for a concern that treats its men as the Cleveland Twist Drill Company does. The wages being the same, there is no question but what the concern that provides the most comforts and up-to-date appliances for their employees will always get the choice of the best and most skilled labor. We have now been running

EAST.—Section No.....

	Total	1	2	3	4	5	6	7	8	9	10
Soup,											
Roast,											
Sausage,											
Wiener-Wurst,											
Hamburg,											
Pork and Beans,											
Potatoes,											
Corn,											
Cabbage,											
Sauer Kraut											
Tomatoes,											
Turnips,											
Parsnips,											
Meat Sandwich,											
Butter "											
Cheese											
Coffee,											
Tea											
Dessert,											

REDUCED FAC-SIMILE OF ORDER CARD.

our restaurant for about a month, and thus far the results have proven eminently satisfactory to us."

MENU FOR WEDNESDAY, DECEMBER 20.

Pea soup	2 cents.
Roast lamb	3 cents.
Stewed tomatoes	1 cent.
Mashed potatoes	1 cent.
Ham sandwich	2 cents.
Cheese sandwich	2 cents.
Bread pudding	2 cents.
Mince pie	3 cents.
Coffee	1 cent.
Tea	1 cent.
Ginger snaps, five for	1 cent.
Crackers, five for	1 cent.

[The photograph shows the men at the tables, and we reproduce the order card referred to.

This is, of course, not a luxurious dining room, and there is a notable absence of cut glass and silverware. The essentials are there, however, and a reference to the menu card shows that a good meal can be obtained at very small cost. It is to be noticed that the matter has not been gone into haphazard, but that some thought has been bestowed upon it, especially in the point of economizing by the prevention of waste, by buying at wholesale and the avoidance of confusion. The means adopted for running the department of cuisine on a strictly cash basis are simple, and some such provision is probably very necessary to its continued success.

We note that many of the men go to the table with their overalls on, and if we may be allowed to make a suggestion we should say that it would be better to remove them. Everything in and about a dining room where men take their meals should be as neat and clean as possible, and this, of course, includes themselves and their clothing.

We are glad to know that the results of this experiment have been favorable, and hope this will lead others to make similar arrangements in places where they are needed.—Ed.]

Calculating Machines.

Calculating machines have been in use for so long and are used at the present time by so many people that it would be natural to suppose that everybody would have some sort of acquaintance with them, and some idea of the principles on which they work. Personal experience, however, shows that a calculating machine is nearly always regarded as a novelty, and usually as something exceptionally wonderful. When people see an oblong box containing sundry cogwheels, handles and brass plates, they look at it with curiosity and inquire what it is, and when the instrument is explained to them an admirable opportunity is afforded of testing the veracity of the observer. If he, and still more conspicuously, if she, professes to understand it, it may be doubted whether the familiar assertion associated with George Washington is applicable. If it is pronounced very wonderful but quite incomprehensible the visitor is probably telling the truth; and yet practically all calculating machines are really very simple. With the ancient abacus, which consists of balls sliding upon parallel rods, most people are familiar, and the Chinese shwan-pan, which is but a variation of the abacus, is well known to many travelers, who are invariably struck by the facility with which calculations are made by its aid.

The first recorded attempt at an arithmetical instrument in Great Britain was made by Napier, the inventor of logarithms, early in the seventeenth century. It consisted simply of a movable multiplication table, somewhat flippantly called "Napier's bones," in spite of the fact that the inventor christened his system rhabdology. There is much that is good about these "bones," but as a calculating instrument it will not compare for a moment with logarithms, for which we are largely indebted to Napier.

The first real calculating machine was invented by the philosopher Paschal, about 1650. He was then a lad of nineteen, helping his father in work which required much calculation, and he contrived a series of wheels connected with one another, with the ten numbers 9 to 0 engraved on each. Addition and subtraction were performed by turning the appropriate wheels by hand, the carrying over being mechanically provided for. The machine was of very little use.

About twenty years later Leibnitz, the mathematician, invented a machine which is believed to have been of an extremely complicated nature, but no clear description of it is to be found. An interesting "calculating table" was contrived by Dr. Saunderson, a Cambridge professor of mathematics, who was entirely blind, and designed the instrument for his own use. It seems to have been a board about a foot square, divided into many little squares, and perforated with small holes, in which pins could be stuck indicating various numbers. It is said that "he could place and displace his pins with incredible nimbleness and facility, much to the pleasure and surprise of all the beholders. He could even break off in the middle of a calculation and resume it when he pleased, and could presently know the condition of it by only drawing his fingers gently over the table."

Whenever calculating machines are mentioned, people invariably think of Charles Babbage, who undoubtedly designed by far the most complete machine that has ever been invented. To describe it in full, and tell the story of its manufacture, so far as it went, would take several volumes, since even a large quarto volume, devoted entirely to the subject, leaves out a great deal about it that it would be interesting to know. Babbage's machine was designed to calculate elaborate tables and automatically set them up in type, or else supply a mold in which stereoptyped plates of the tables could be cast. After many experiments, he constructed his first difference engine, as he called it, for the reason that he employed the method of differences as a general principle on which to base the calculations. As soon as the first machine was completed, Babbage received instructions from the British Government to construct another and more comprehensive one at their expense. Six years after this order was given the Treasury appointed a very strong committee to examine and report upon the portion of the machinery then executed and the design for the whole engine. The result was a very strong expression of opinion in favor of the machine, but the expense was enormous. The Government finally declined further supplies, and in 1833 the construction of the engine was relinquished. The second difference engine was a huge instrument of marvelous power, and an illustration, that Babbage himself uses as a kind of illustration of a miracle, shows one feature of its performances in an interesting way. He said that his machine could go on for years working by the same formula. It could then change without human intervention to another formula for a single

calculation, and subsequently resume working by the original formula.

But, great as were the powers of this second difference engine, Babbage had conceived an even more elaborate machine, which he called the analytical engine, which would completely supersede the difference engine, on which, in its incompleted state, the Government had already spent £17,000. It is not wonderful that the Chancellor of the Exchequer declined to supply any more funds under these circumstances.

Two practically useful machines were, however, constructed on Babbage's principles, one of which, made by Scheutz, a Swede, was completed at a total expense of £560, which was provided by the Diet of Stockholm. This machine was about the size of a small square piano, and would calculate and stereotype without chance of error two and a half pages of figures in the same time that a skillful compositor would take to merely set up the type for a single page. The machine was purchased for £1,000 and presented to the Dudley Observatory at Albany, N. Y. A second Scheutz machine was made for the English Government for £1,200, and was used for, among other work, portions of the English Life Table No. 3. The machine consists of over 4,000 pieces and weighs about half a ton.

Since Babbage's day many small calculating machines of various kinds have been invented, and when the present writer searched the records of the Patent Office to see if an invention of his own had been anticipated, he was surprised to find that an enormous number of patents for such instruments had been taken out. The specifications proved very interesting reading, and exhibited for the most part a remarkable amount of ingenuity, which, sad to relate, must have involved the inventors in a very large expenditure, from which they received no return; but this is the ordinary fate inventors meet with.

There are practically only five of these machines that are worth mentioning. One of these, invented during the past few years, is Burroughes' registering accountant, which performs addition by striking keys like those of a typewriter, and at the same time types on a strip of paper the amounts that have been added. This machine seems to be mechanically successful, but, so far as the writer is aware, it is not now commercially obtainable. It is somewhat heavy and cumbersome, requiring ten keys for every column in a row that it is desired to add. An obvious improvement would be to put the calculating mechanism on a carriage like that of a typewriter, and use ten keys in all, instead of the seventy or eighty keys that in its present form the machine requires.

Another moderately practical machine is an American invention called the comptometer. This also is actuated by keys like those of a typewriter, and by means of it it is simple to add, feasible to subtract, and within the bounds of possibility to multiply or divide; for the latter purposes it is altogether inferior to Tate's arithmometer. A machine that has much that is pleasing about its design is the Brunsviga, but its workmanship is not sufficiently good to stand much wear and tear. The writer obtained one about five years ago and has long since worn it out.

The only really satisfactory machine for multiplication and division was invented by Thomas de Colmar about 1850. This was subsequently improved in design and workmanship, without being altered in principle, by an Englishman named Tate, and years of hard work at one of these machines has led to the keenest appreciation of its powers. It never makes a mistake, it practically never gets out of order, it performs multiplication and subtraction with ridiculous ease, it makes the abstraction of the square root quite a fascinating operation, and for many purposes can be used by an unskilled operator with entire confidence that the calculations will be correctly performed. The arithmometer is largely used by life assurance companies, and anyone whose work consists to any great extent of calculations can scarcely be too thankful that it was invented. It is contained in a box about 2 feet long and 6 inches high, and is the machine referred to at the beginning of this article.—"Pall Mall Gazette."

It is probably not generally known that Geo. B. Grant, of gear-wheel fame, invented a calculating machine of great ingenuity and having many excellent features, especially as a multiplier. This operation it performs with great facility and absolute accuracy. It also adds, subtracts and divides. In this machine there are a number of small gear wheels with numbers on them which are revolved by movable racks, each rack being set by means of pins to figures indicating the amounts to be handled. After that a revolution of a crank adds the amount, or continued turning of it multiplies the amount, and the device for "carrying" from one wheel to another is particularly ingenious.

An ingenious arrangement to prevent overcrowding of stairways and elevators when entering or leaving a building is used in the main office of the International Correspondence Schools, Scranton, Pa. The time of entering and leaving the building is regulated by clocks on each of the five floors. On the lower floors the clocks are set correctly, but on the upper floors they are a few minutes slow; so that the employees on the lower floors are at their desks before those on the upper floors are due at the building. In leaving the building the employees on the upper floors do not leave their desks until several minutes later than those on the lower floors. Over 500 people are employed in the building, which is used exclusively by the International Correspondence Schools.

Early Days in Mine-opolis—A Steam Pump as Motive Power—Machinists in the Foundry—Curing an Obstructed Steam Pipe.

At the Mine-opolis Foundry and Machine Company's plant the main engine was a remodeled flywheel steam-pump, cylinder about 8 inches bore and 6 inches stroke. The connecting rod was bifurcated to straddle the water cylinder. The remodeling consisted in throwing away the water cylinder and placing a plain bracket in its place, to support and guide the piston rod. This up-to-date prime mover was one result of the Old Man's trading proclivities. He traded the old engine, a good 9x12 plain slide-valve engine, amply powerful for its work, for the said steam pump and some money, saying that the 9x12 engine was bigger than was necessary, therefore wasteful. Now, thought the O. M., we'll get better economy. The cupola, about 42 inches in diameter, was blown by about a No. 5 fan blower, and when the remodeled engine began to blow the first heat, 100 pounds steam pressure, all he dared give the old boiler, would give only about one-half the necessary engine speed. Something had to be done at once. Mike, the foundry foreman, entered the motive power department with remarks not adapted for publication, and the O. M. shouted, "Throw off the machine shop belt." The chief engineer, who did considerable business at the drill press and made himself generally useful, at once shut her down and worked off the main belt. The O. M. meanwhile had thrown off the governor belt. Thus relieved, the F. W. S. P. engine, which was belted direct to the blower, got up a fair speed, when the throttle was wide open. "Well, boys," said the O. M. to the machinists, "you'd better go into the foundry and help them off with the heat. You see," said he to the machine shop foreman, "we have to have several of them to help off the heat anyway, and if we have plenty of help we'll not lose so many castings." So thenceforward the machine shop suspended business when the foundry began melting.

Sam Better had some interesting experiences in the Mine-opolis foundry. Mike, the foreman, was a great man for getting up a big day's work and then losing about 50 per cent. of it through poorly anchored cores, flasks not clamped, poured short, etc. Scabs, blowholes, swells, broken cores and various deformities were leading characteristics of his work. A visitor from a well-ordered foundry would have thought this one a pandemonium at casting time. At the beginning of the heat Sam usually "tapped out" the cupola into the 800-pound ladle and poured from that into the shank ladles. About the time the first heavy casting was nearly poured, Mike, who had been commanding at the top of a high-keyed voice: "Light that

vent; pull off that stopper; pour in, there; *pour in!* POUR IN! keep that runner full; somebody bring some clay, QUICK," would rise to a grand climax and deliver an ear-splitting yell, "SAM, TAP OUT A LITTLE IRON, QUICK!" The sequel to this remark was usually a cold short casting.

Adam, the melter, had a habit of making the stopping clay and the cupola breast very wet, and as a result Sam decorated himself with burns from the spluttering iron when stopping the tapping hole. On one occasion the breast, being made too soft, caved in entirely with the pressure of the tapping bar, and resulted in spreading half a ton of iron all over the cupola room; scorching the soil of Sam's future whiskers, causing a general sociable time for all hands and delaying the heat half an hour or more. After this occurrence Sam reasoned with Adam and induced him to mix the clay drier, which ended the trouble. As soon as the iron was all charged Adam usually came down and tapped out while Sam poured off sash weights—one or two dozen flasks. The molders were nearly played out by this time. On cold winter nights the steam, core smoke and gas were often so thick it was impossible to see a big oil torch ten feet away. The sash-weight flasks, for want of room, were put in rows so close together that the handles lapped, and walking between these handles and pouring with a heavy shank ladle in the dark was not unmingled felicity. Spilling a few pounds of iron for a light to show the gate was a regular practice. A number of flasks were usually piled on top of the others, and after the lower ones were poured, the men walked on them while pouring the upper ones. Occasionally a molder would be overcome by the gas and have to be helped out into fresh air. On one occasion the O. M. was carried out insensible. After the heat was over nearly all the work had to be shaken out, and the flasks, all of wood, piled up.

Eliphalet Cork, the chief engineer and all 'round mechanic of three months' practical experience, noticed one day that something more than usual was wrong with his F. W. S. P. engine, and sought advice from Vine, an experienced machinist. "There's 90 degrees of steam on that there steam clock," said Cork, "but she's running awful slow. Somethin's wrong." Vine was not averse to a little joke at the C. E.'s expense, so he at once explained: "Your steam pipe is stopped up; there's something stuck in it. Take that scantling and pound on it; that'll loosen it up and it'll blow through." Eliphalet thankfully adopted this wise counsel, while Vine quietly invited one or two other machinists to note the result and join the laugh. Vine's jaw almost fell off when he saw the engine jump up to speed at the first lick. The governor stem, badly worn and tightly packed, had stuck down and the slight jar was all that was necessary to loosen it and give the engine steam. Vine has never mentioned the incident since, and the C. E. will believe till doomsday that he loosened the obstruction and blew it out through the exhaust.

Springfield, Ohio. THE JUDGE.

A Portable Drilling Tool with Suction Support.

The following description of a portable drill for use in shipyards, invented by M. L. Moissenet, engineer of naval construction, I translated from the "Genie Civil." This drill is considered remarkable on account of its novelty, as well as because of the numerous applications to which it is adapted.

The tool comprises an apparatus for adhesion and an apparatus for drilling.

The apparatus for adhesion serves to secure the bench which forms the point of support for the drill. It comprises the suction block or bed which is fixed upon the surface where the work is to be performed; the pump or receiver by means of which the vacuum is obtained, and the bench or stirrup (or as we should probably term it, the "old man") which is held in its position by means of the fixed point which the suction block furnishes.

The body of the suction block (Fig. 1) is of bronze. It is in the form of a cylinder of large diameter and very little hight, the base of which is joined to a truncated cone greatly flared out. All of the outside surface of the cylinder and of the conical piece is covered with oiled leather, held in place by a bolted or riveted copper hoop. The interior surface of the body of the suction block is slightly concave, so as to allow an empty space of small volume between the block and the surface upon which it is applied. The exterior part of the block carries an anchorage ring which passes through an eye bolt screwed in a central boss, also the cock which allows communication with the apparatus producing the vacuum.

The vacuum is most often obtained by means of a little pump, which, in the case of electric drills, is operated by the motor that drives the drill. Gear wheels serve to connect and disconnect the pump and to reduce to one-fifth the number of revolutions. The usual speed is 400 for the motor, 80 for the pump. The packings of the piston and the valves are of metal. The vacuum obtained is about 70 centimeters (27.5 inches) of mercury.

The vacuum is maintained in the suction block about a quarter of an hour, when the pump is disconnected. It will hold for several hours if the suction block be put in communication with a receiver in which a vacuum has previously been produced. The same receiver will answer for several suction blocks. The leather is rendered air tight by previously coating all its lower surface and its circumference with a pasty substance, such as tallow or suet. Release is effected immediately by closing the cock and raising with the thumb the copper hoop.

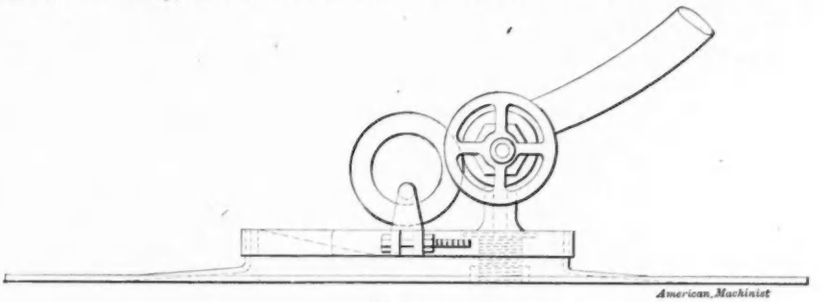


Fig. 1

SUCTION BLOCK WITH APPLIANCES.

Fig. 2 shows the combination of the electric motor *D* with the pump *p*, the vacuum receiver *R*, the suction block *V*, anchoring the support *B* of the drill, and finally the drilling tool *P* with its flexible shaft *F*.

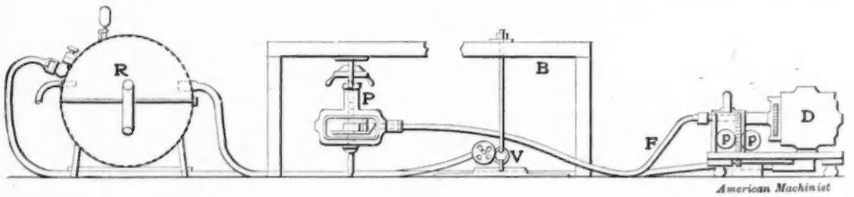


Fig. 2

DRILLING-BENCH ANCHORED BY SUCTION BLOCK.

The apparatus is essentially light and portable. A suction block of 40 centimeters (15.75 inches) diameter, giving an adherence of 1,200 kilograms (2,640 pounds), with a vacuum almost 1 kilogram, weighs not over 9 kilograms (20 pounds) with its immediate accessories. The pump augments the weight of the dynamo by only 19 kilograms.

There is an arrangement for running the tool by hand when the electric current fails. A shaft with two cranks and a fly-

wheel carried upon a special frame actuates the flexible shaft and the pump.

Finally, if it be desired to use a ratchet drill simply, the vacuum may be produced in the receiver by expelling the air with a current of steam, and then condensing it by wetting the outside with cold water.

These appliances of pneumatic adhesion appear to present important advantages over other devices for accomplishing that end. They give considerable adhesion, with but a very small weight of appliances; they are easily portable and may be rapidly and securely set up. They adhere to any sort of surface, whether thick or thin, bare or painted, to sheets of copper or bronze, to wooden or stone walls, and even to irregular surfaces. All the parts of the apparatus are simple and strong. A single pump may serve for several receivers, so a shipyard may be equipped with this system at little expense.

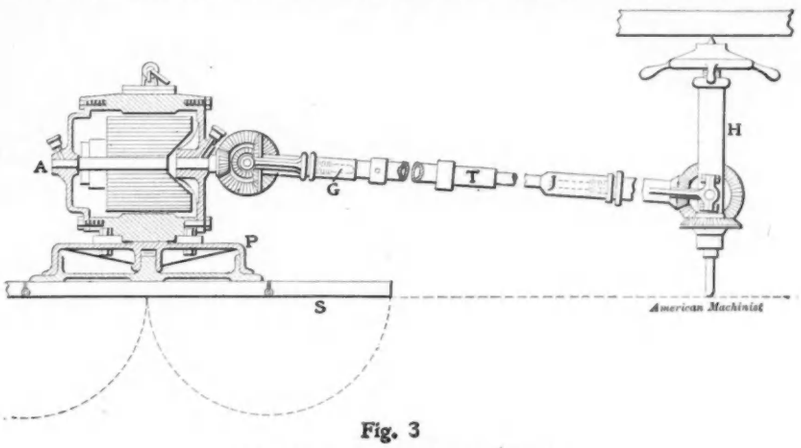


Fig. 3
GENERAL VIEW OF THE APPARATUS

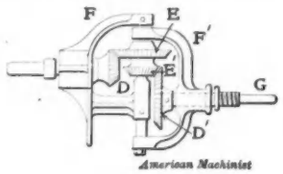


Fig. 4
SYSTEM OF GEARS.

This apparatus has been supplemented in a very ingenious fashion by a new portable drill which does away with the flexible shaft. Fig. 3 represents the assemblage, which comprises a motor *A* mounted upon a revolving plate *P*, with a wooden base *S*, which is made in three parts hinged together, so that it may readily be carried through small openings.

A system of bevel gear wheels composed of two pairs at right angles, *D*, *E*, *D'*, *E'* (Fig. 4), with supporting forks *F F*, allowing the movement of the end of the shaft *G* in any direction over more than a hemisphere; a telescopic shaft *T* (Fig. 3), allowing a variation of the distance of the tool from the motor. The shaft is perfectly smooth outside, and this avoids the necessity for a casing.

A drilling tool *H* (Fig. 5), with three bevel gears, permits the end of the shaft *J*, Fig. 3, to move around the spindle of the drill, upon which is secured the extremity of the telescopic shaft.

It will be seen that the telescopic shaft with the conical gears arranged at its extremities allows the positioning of the drill freely about the motor as would an ordinary flexible shaft. The telescopic shaft is lighter than a flexible one; its weight does not exceed 6 kilograms. It is not subject to easy damage nor to rapid wear. The mechanical efficiency of the device is much superior to that of the flexible shaft. The efficiency of the latter is hardly greater than 35 per cent., while the gearing which replaces it may, if carefully cut, have an efficiency of 70 per cent. This increase is very valuable; it enables a motor to drill more rapidly holes of a given diameter or to drill larger ones.

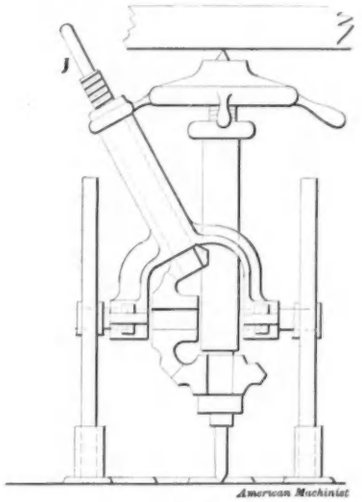


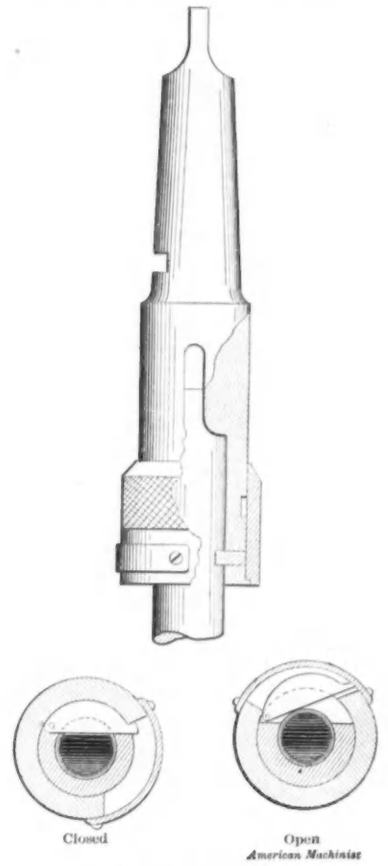
Fig. 5
DETAIL OF DRILLING TOOL.

E. P. BUFFET.

We describe elsewhere an automatic screw machine which for some time has been making brass screws and other small pieces, for which the chips made by it were all the pay the owners of the machine received.

A New Drill Socket.

The newest thing in the way of a drill socket designed to prevent twisting off the tangs is shown by the accompanying engraving. The new feature consists of cutting a rectangular notch across the taper shank, as shown, into which a hinged steel plate is locked by rotating upon the collet a collar the construction of which is shown very clearly by the engravings, and which when in one position allows the plate to swing outwards and free the drill, and when rotated to another position forces the plate into engagement. It is stated that this device has been used sufficiently to show that it is practical and that it prevents broken drill shanks. It is made by J. L. Cook, Springfield, Ill.



A NEW DRILL SOCKET.

Admiral Melville's Report.

We can give a good synopsis of Admiral Melville's recent report, and at the same time an insight into many of the points of knowledge of naval engineering gained by British experience, in no better way than by reprinting the editorial comments of "Engineering" upon the report; and it will be noticed that experience in both countries teaches much the same lessons. The article is as follows:

The report for 1899 of Rear-Admiral Melville, the chief of the Bureau of Steam Engineering of the United States Navy, which has recently been issued, is of more

than ordinary interest, as it deals with the period, following the war with Spain, when the United States Navy had time to consider the result of warlike operations, and to profit by the lessons learned. The amount appropriated for the fiscal year which ended June 30, 1899, amounted to $6,240,000, or somewhat less than a million and a third sterling. Admiral Melville is noted for the fearless manner in which he speaks his mind in his reports, and while he thanks Congress conditionally for a more generous appreciation of the needs of the Navy than at one time prevailed, he shows pretty plainly how the gift was rendered futile by the conditions which surrounded it. By Act of Congress is was provided that three sea-going coast-line battleships, three armored cruisers and six protected cruisers should be laid down, but at the same time such limitation was placed on the price to be paid for armor that the manufacturers of that commodity simply refused to make contracts at the statutory figure; preferring, as they said, to devote their resources and energies to foreign orders, on which there would be a profit, and of which there were plenty, rather than to home orders on which there would be a loss.

The Act of Congress further contained a clause which forbade contracts being entered into for the hull until the contracts for the armor of the battleships and armored cruisers had been placed satisfactorily. Under these circumstances Admiral Melville and his staff have had no alternative but to confine themselves, so far, at least, as new work was concerned, to the designing of the machinery for the six protected cruisers, the other work having been brought to a deadlock. It is, perhaps, not without a spice of amusement that the armor-plate makers of the country find the naval authorities in rather a tight place. They will remember the somewhat severe manner in which they were lectured on their shortcomings not very long ago, and now they find the game in their own hands so long as they play together. They know very well that a mistaken patriotism will not allow foreign material for the Navy to be imported; and, of course, the ships must have armor. There is, naturally, the alternative, which doubtless they have considered, that the Government may determine to form an establishment for making its own armor. The step would be favored by unthinking people, who form a majority in all countries, because there is nothing that seems to add to the glorification of a nation more than the multiplication of public factories and institutions. It is hardly necessary for us here to refer to the disadvantages, and even the danger of depending on governments for manufacturing operations, unless the public are brought into immediate contact with the output, as they certainly are not in the case of war material. However, it is to be hoped that Congress will exercise a little wise discretion, and the armor-plate makers some, possibly not unprofitable, patriotism, which will enable the work of shipbuilding and engine designing to proceed on reasonable lines. Certainly the late war ought to teach Americans the folly of naval unpreparedness, for though they had last time a walk-over, they could hardly hope again to be opposed to a navy so hopelessly unprepared as was that manned by the brave but unfortunate sailors of Spain.

Admiral Melville says that the general lessons of the war were in no way indicative of any desirable change in the machinery of the American ships, excepting in regard to evaporating machinery and water-tube boilers. Evaporating plants, the report said, should be increased, and the water-tube type of boilers should be adopted "with all practical and economical promptness." As fast as the present outfit of Scotch boilers becomes inefficient, the newer type is being substituted. We would beg attention to these words on the part of those gentlemen in our own Parliament who have been so vigorous in attacking Admiralty engineers for adopting the water-tube boilers in the British Navy. The retention of the "Scotch" boiler, by which is generally meant the cylindrical return-tube boiler, in the American ships was an argument so often advanced against the course adopted at Whitehall, that we have no doubt, when next the subject comes up for discussion in the House of Commons, the passages from the report will be duly quoted by the advocates of the new system. The type of boiler especially referred to by name is the Babcock & Wilcox. It has been substituted "for the old Scotch boilers" as a "direct result of the unqualified success of this type of boiler on the 'Marietta' and the 'Annapolis' in the United States service, and in various other ships of the Navy." "The experience," the Rear-Admiral adds, "renders their adoption, to the extent already made, absolutely safe." The Niclausse and Thornycroft type are also referred to, and this reference to the subject concludes as follows: "The status of water-tube boilers at the present time is much more doubtful regarding the possibilities of protection from deterioration while not in use than in regarding their efficient output during actual service. This ability or inability to properly protect such boilers is of vital importance, and largely governs the annual cost of repairs to naval machinery." Later on in the report details are given of some interesting trials made with water-tube boilers, but there we will leave for the present.

The Americans have, like ourselves, a vessel named the "Vulcan" attached to their Navy as a repair ship. In the report of 1897 the desirability of fitting out a vessel as a floating repair shop, on the lines of H. M. S. "Vulcan," was urged by the Chief of the Bureau. Nothing appears to have been done (for the Americans are largely of the same blood as ourselves) until war became imminent, and then in a hurry a second-hand steamer named the "Chatham" was bought, and everything was done that could be done to make her appropriate to the service; including rechristening her the "Vulcan," which, at any rate, was a cheap and expeditious step. However, a good deal more than this was undertaken once Admiral Melville had authority to proceed. Machine tools, a cupola, forges, brass furnaces, etc., were put in her, and a selected force of skilled mechanics was engaged. When the "Vulcan" arrived at Guantanamo she proved of the highest usefulness to the fleet, making repairs of all kinds, and furnishing much-needed supplies to every department of nearly every vessel. Although the United States "Vulcan" did such good service, it has since been found that she might easily have proved as great a failure; and, to quote the last report, "it was by accident alone the absolutely necessary work demanded of that ship was well within her capacity." The hull was found to be in such bad condition that the vessel had to be stripped and got rid of. Admiral Melville, last year, before the "Vulcan" was found to be so defective, urged the need of another repair ship for service in the Pacific; and we conclude he would now desire that two vessels of the kind should be built.

The subject of "Personnel" is one specially interesting just now, owing to the fact that the present report is the first which has been issued by the Chief of the Bureau of Engineering since what was known as the "Personnel Bill" became law. We have already dealt with this subject at some length at the time of the passing of the act, and it is with considerable regret we observe the note of disappointment that dominates Admiral Melville's remarks. He says that he approaches the subject with hesitation, owing to inability to see indications of the desired results from the operation of the bill thus far. He had hoped that the whole trend of detail would be toward the complete amalgamation of line—or, as we should say, executive—and engineering interests, and at the same time that there would be the most favorable outlook for engineering science. The Chief of the Bureau believed that the spirit of the bill contemplated great additions to the number of officers who would give earnest attention to engineering matters, and he in no way anticipated that the measure aimed at augmenting the forces available for merely line (executive) or deck duty.

The plain fact is, though the report does not state it in set terms, that a number of engineer officers of the United States Navy —perhaps more especially among those who are removed from personal considerations by seniority or otherwise—consider that by the Personnel Bill they have been "hoist by their own petard." As the Rear-Admiral says, they anticipated the general body of officers would be amalgamated,

and though some would specialize—as our own executive officers do in the gunnery, torpedo or navigating branches—yet, to quote the words of the report, "the duties of the line were believed to be perfectly compatible with a professional excellence in engineering matters." It was further thought, to again quote Admiral Melville's report, "a not unwarrantable expectation that preference for the mechanical part of the combined duties would be shown by a great number, owing to the intense interest attaching itself to this field of work."

It would seem to us, judging from what we have lately seen and heard, that there are no signs of the sanguine expectations being fulfilled in a general sense, unless some pressure is brought to bear. The report urges the need there is to "insist upon the present line officer adapting himself as soon as possible to the new conditions, and increasing, where lacking, his knowledge of mechanical engineering." That is what "the present line officer" appears by no means anxious to do; or, at any rate, a certain number are not. On the contrary, the scheme popular in some quarters is to have a class of warrant officer who shall "do the actual work," and save the fine gentlemen from soiling their hands. We are not sufficiently acquainted with the line officers of the United States Navy to say how general this feeling is; it may be shared only by a small residuum whose ability to make themselves heard is very largely in excess of their real importance. Perhaps it is their friends who speak chiefly for them. At any rate, the scheme is extant.

We have had exactly the same idea put forward in connection with our own Navy by those who see that the executive branch is waning in importance, in consequence of the growth of engineering afloat. It is desired by some to assume the dignity that attaches to true usefulness without the unpleasant experience—the dirt and the drudgery—that must be gone through in order to acquire the necessary practical and theoretical knowledge that entitles a man to call himself an engineer. Of course, the scheme must fail utterly, and in time honest engineering ability would triumph. It would just be running the race over again, starting, as it were, another heat; for the warrant machinists, or engine-room artificers, as the case might be, would become the true engineers, their examinations would become stiffer and stiffer, thus entailing an expensive education, pay would increase, and, lastly, the men of higher status that would be attracted to the service would demand recognition in accordance with their birth, education and social status, just as the engineer officers do now.

But all this would take years to bring about, and in the meantime what might happen? We, or our cousins across the Atlantic, might find ourselves entangled in a really serious naval war with the most vital part of a ship's economy actually under the charge of men not qualified to lead either by education or social fitness; while those nominally in command would be debarred by ignorance of their proper duties from playing any useful part. The engine room of a warship during a hardly contested engagement would be nothing less than a pandemonium of disaster, and possibly of insubordination. To maintain discipline, officers must possess the respect of their men, and to gain this they need that full knowledge of their duties which only comes by actual experience. We want no superfine naval officers in the present, any more than they were wanted in the past days, when our last sea battle was fought nearly a century ago. Then every young officer had to go through the "tarry breeches" stage until he had mastered the practical part of his craft, seamanship. Now it is engineering. Greasy-jacket has ousted Tarry-breeches.

To do no more than justice to our naval officers, they stick at nothing in the way of hard work when they are convinced of the need of it, especially in the way of fighting. But the oil and cinders, and the drudgery of the engineering are so unlike the fun and adventure of fighting, that young men may perhaps be excused for not seeing the connection, while older men have become set by habit. Modern warfare is, however, nearly all engineering—the greasy jacket must be worn.

Letters from Practical Men

Some Items of Circumstantial Evidence.

Editor American Machinist:

I hope that my little suggestions sometimes provoke somebody to do a little additional and independent thinking along the lines suggested. It is a rather curious fact that they do have that kind of effect upon me, for after I have just hustled off a little letter to the "American Machinist" there is almost always something more that still keeps thinking itself along. It is the combined effect, I suppose, of the automatic action and the inertia of the thinking apparatus.

I was speaking in my last letter about circumstantial evidence, and as a consequence I have been thinking circumstantial evidence since. Some may not appreciate it, but to me it is continually astonishing how much a single little circumstance will tell me. Some unconsidered act of a man will compel me to believe many things in detail concerning his character and habits, some way in which a certain operation is done in a shop, or perhaps merely the time occupied in the doing of it, is apt to strike me as typical, and the single circumstance often compels me to infer many others that must fit with it. I never look for these things, but I sometimes can't help seeing them.

The other day I was in a shop where they build planers, very good planers too, and they have built a great many of them, and I came along to where they were planing a platen for a good-sized planer. The top of the platen had been planed, and it was stood up edgewise on the back edge, and the other edge, with the slot in it for clamping the dogs, was being planed. That may have been all right, but it would take a month of Sundays to convince me of it, and then I wouldn't believe it. The top and both edges should have been planed at the same setting, and, in fact, after the piece had been set, in a shop where this job was continually recurring, the planing operation should be going on upon all three sides at once. That was a typical circumstance in one shop.

It curiously happened that the very next day I was in another shop where a different kind of circumstance struck me. I came along to where an automatic machine, one of several similar ones, was at work. This machine was operating upon a bar of 2¼-inch round tool steel, turning the edges, facing the front sides and cutting off blanks about 2 3-16 inches in diameter and 1 inch thick, and it was running at 125 turns a minute. The finished diameter of the pieces—I do not give the precise measure of them—was not allowed to vary more than half of a thousandth of an inch. Anybody that works tool steel will appreciate the feat of making tools stand up to work like this. The work was constantly deluged with oil, the composition of which, by the way, was one-half lard oil and one-half paraffine. The paraffine was said to have the double effect of curing all tendency to gum, and to entirely prevent spontaneous combustion. Now that was another typical circumstance, and I am personally of the opinion that it and the one noted in the previous paragraph could not coexist in the same establishment or under the same superintendent. In every concern things have to match to some extent, and that is why these typical circumstances can tell us so much.

Perhaps a third circumstance will be enough to trouble anybody with at the present time. In still another shop, where they said they were very busy, as everybody is quite in the habit of saying just now, I came along with the superintendent to where there was running one of those combination machines that do the work of half a dozen lathes or more, and do it better. I need not mention the machine more specifically. It is not a stranger to the readers of the "American Machinist," and both the machine itself and its inventor and its builders are very competent to advertise and push it, and they might not thank me for taking their work out of their hands. The superintendent spoke in high appreciation of the excellent work that the machine was doing, and the quantity of it, and he said that he wished he had a couple more of them and could keep them busy right along, but there was not a ghost of a chance of his getting them.

That is a typical circumstance that hits high. If that concern does not turn out as much work as it ought to, it should not be difficult to locate a big hunk of the blame.

Hitting high is, after all, generally the correct style of hitting. The Donnybrook Fair rule, "Wherever you see a head, hit it," is the way to win the fight. The problem of properly paying for work done, and of getting as much work done as possible is not likely soon to be completely solved. Almost anybody can find fault with any shop conditions in this regard, but still some practices are better and more successful than others. I confess to having strong in me the instinctive appreciation of prolific accomplishment. I believe in what has been, and I hope will continue to be, the distinctive idea of the American shop to do all that you can and to get all that you can for it. Well, I go into a certain shop, and this also is a recent occurrence, and I am told that nearly all the work in the shop is piece work. But the gait of the shop is certainly not the piece-work gait. Why, the men are running the tools with the slow speeds and the fine feeds that I remember in the fifties. I don't see anybody anywhere who could not evidently do considerable more if they made an effort to, and without hurting themselves. Obviously they are victims of the management. There is kicking in the office and cutting down of prices at once if the men get above day wages with a slight percentage added. There is not much probability that men will make fools of themselves. It is a curious thing that the office can so easily devise a scheme whereby the management must reap substantial benefit, and then as soon as the men also get some good out of it the office at once beats itself out of its own share. At least, this is the suggestion of another recently observed typical circumstance.

TECUMSEH SWIFT.

Keeping the Cost of Tool Work.

Editor American Machinist:

I wonder if any of your readers who are manufacturers, and make their own tools, are troubled about keeping an exact cost of the same. I don't mean the big firms, who have a clerk and bookkeeper in every room, but the little fellows, who run from four to ten men in the tool room, and where the foreman has to be all, and do all, and doesn't have much time for bookkeeping, and doesn't know how even if he has the time. I send a form I have used for some years that will fit such cases exactly, and it doesn't take a bookkeeper to keep it either.

Whenever it is desired to make a die, tool or jig the order is filled out on the front side, Fig. 1, by the foreman, and signed by him or anyone else, and when the time cards are turned in the next morning the time on each job is jotted down on the back of the form as shown in Fig. 2, and the stock is also charged on the same sheet.

All time is taken at the same rate, as it would materially increase the work if the foreman had to take the exact rate paid each man. Fifty cents an hour is a fair price, and it is easy to figure up. An estimate is made on each job, and if the foreman is any kind of a man, he can soon tell to a dollar what any tool he has ever made will cost.

Repairs on different machines can be

TOOL ROOM ORDER.

Order No. 326

Tool No. 1

Name 4" square Punch and Die

Operation Blanking, Fit to Bliss Press, No. 401

Ordered by Mr. Miles, Supt. Date 12 — 12 — 1899

Commenced 12 - 14 '99 "

Finished 12 19 " "

Cost 15 hrs. @ .50 7.50

Stock, 24 lbs. tool steel @ .16 3.84

$11.34

Signed A. P. Press, Foreman.

American Machinist

Fig. 1

FRONT SIDE.

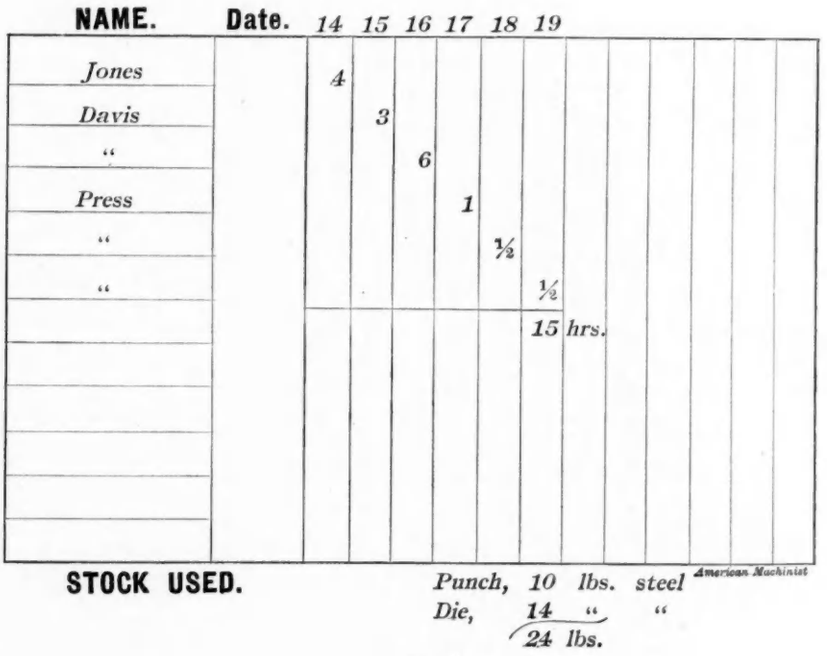


Fig. 2

REAR SIDE OF TOOL-ROOM ORDER.

kept in the same way, and one can tell at any time just where he stands on the cost of a tool.

When two or more tools are used in a set, I keep the cost of each separate by giving it a second number, as blanking die No. 326-1, and the next die No. 326-2, and so on.

Should any brother foreman know of a better way get him to tell us how he does it, for if there is any way to make a foreman's berth an easy one we all want to know what it is. A. P. PRESS.

Hydraulic Limitations.

Editor American Machinist:

I have read with much interest the many articles by Tecumseh Swift, and especially the one in December 21 issue, in regard to the use of liquids for driving planer platens and feeding devices. Now, there is no doubt that a planer could be made to run with a liquid and have plenty of push, and also quick return, and a number of advantages over the present planer. But along with these advantages would come a great number of disadvantages. We are all well acquainted with planers that have run for ten, fifteen or twenty years, with remarkably small expense for repairs. How many pumps do we know of that would run that long with fifty times the expense for repairs?

We are often told that water is a good lubricant. If it is, how do you account for the oil industry attaining such proportions and getting up in a corner? Water is surely no lubricant, hence journals and bearings running in oil will wear many times longer than pistons or plungers running in water. Of course oil could be used instead of water, but that is objectionable on account of first cost and waste from leaks and ruptures and getting thick in cold weather.

A planer with the four valves, as suggested by Mr. Swift, would not make one stroke. It would move until the tappet struck that bunch of levers and move them until the liquid was shut off; then it would take a rest. A planer cannot be operated on the principle used for steam or air hammers. A planer platen would not run far after the power was shut off. The trick is, that there must be some device to move the valve, or valves, when the platen and all of the parts are in a state of absolute rest. Hence, there must be some arrangement adopted similar to the valve mechanism used for throwing the valve on direct-acting steam pumps. There is no trouble to get this valve device to work, but it complicates the machine and shortens the life, besides calling for early repairs.

It seems to me that the planer on the design suggested by Mr. Swift should have a cylinder somewhat longer than the stroke, with the platen attached to the piston, or the cylinder could be fast to the platen, and the piston or plunger fast to the frame of the machine. In either case the cylinder or piston would have to extend to a considerable distance beyond the frame and be objectionable. And if a device were used so that the planer would travel farther than the piston, the machine would be quite complicated. If I were a planer builder I would have no fears of an early substitution of hydraulic planers for the present type.

Liquid pressure could, no doubt, be used to an advantage for some of the different feeding devices, but it seems to me that the most desirable use that could be made of a hydraulic plant in manufacturing would be, for the operating of forming machines of different kinds, punch presses, mandrel presses, nut machines, etc. I am aware of the fact that hydraulic machines for these purposes are in use, but they are not common, particularly in the smaller sizes.

Forming and other presses, operated by cam, eccentric or crank often go to pieces from the stock being over size or from an accumulation of scale, causing the pressure to run up to the breaking point, where, if worked hydraulically, there would be no such trouble and the pressure would be the same in all cases.

HUGH HILL.

Anderson, Ind.

The Reference or Premium Plan Criticised.

Editor American Machinist:

In your issue of the 7th ult. you publish, under the head of "The Reference or Premium Plan," an interesting article from Leicester, England, by Mr. Isaac Ross, on a manner of adjusting wages, which I respectfully submit is in its nature a partial application to a small and uniform manufacture of the system explained in your issue of August 24, 1899, under the head of "A Logical System of Wages."

Mr. Ross at the outset says he sets a wages limit for each job, which is precisely what was proposed in the former article as an "estimate." The time charged to the job on the reference sheet is deducted from the wages limit, or the estimate, and is paid not as a "premium," but as equitable wages for the work done, but the disposition of the surplus is decidedly on the premium plan, in that one-half is given to the workman and half to the works. Now, unless the wages limit is in excess of the normal rate, where does the owner's part come in, unless it be to pay for a complicated system of having a part of the men working to estimate and another part working by time? The surplus earned is not taken from the works; indeed, the labor cost of the product is lessened by the surplus wages, because of the expense account being charged, not against the work, but against "time." I mean the charge for superintendence, rates, lights, interest, power, etc.

I submit that such a system is open to the objection of setting up in a works an inequality of conditions and causing discontent among workmen. It permits scamp work, because the men are not responsible. Mr. Ross admits this. The system is paternal in nature, as all premium plans are, with some means of taking from the men a portion of their honestly earned wages. The plan may be adapted to the class of workmen employed in an organized manufacture, but would not do in a machine tool works or any other of the same grade in this country or in England.

It would be a matter of interest to know why Mr. Ross does not set a wages limit for all of his work, pay to the men the wages they earn and hold them responsible. "The alert foreman" could then give most of his attention to some other duties, and the man who scamped his work would be watched without expense to the owners.

It would also be interesting to know the grounds on which one-half of the surplus wages goes to the firm's account.

San Francisco, Cal. J. RICHARDS.

Planer Tables Corked.

Editor American Machinist:

In the tool shops of this city it has become quite general when setting up planers of the deep-bed type, of 30 inches or over, to put the bed down on the foundation, making it some few inches higher and leaving off the short legs. Then the bed can be plastered with cement its entire length, which I think gives the most solid job, and that is an important point in a large planer. There is more trouble to keep the chips and dirt from the inside of the bed and around the gearing when the bed is set down this way, and I have no doubt there have been more gears broken than the few I know of that were caused by allowing the chips to pile up too high.

There is an easy way to prevent the chips and dirt from piling up around the gearing inside the planer, and that is to cork all the stop holes up. I have found that by using corks this way it keeps the inside from getting striped with oil or soda water, and the corks also keep the holes clean and free of gum, which saves cleaning them out to admit a nice fitting stop.

I have seen planer tables which were not drilled all the way through, where the dirt would have fallen around the gear. That made it necessary to be scooping and cleaning the holes out when you wanted to put in the stops, as the holes would get rusted and gummed, and if they were corked it would require a corkscrew to get out the corks, while if the holes go clear through you simply get the cork out by pushing it in; then pick it up later.

Cincinnati, Ohio. H. L. CAMERON.

The "Century Dictionary's" Gas Engine.

Editor American Machinist:

It must be a good deal of a job to make a book like the "Century Dictionary," "a work of universal reference in all departments of knowledge," claiming to correctly define about 450,000 words.

Being much interested in internal combustion motors, I looked for the "Century Dictionary's" ideas of such things, and found:

"Gas engine (gas'en"jin), *n.* An engine in which motion is communicated to the piston by the alternate admission and condensation of gas in a closed cylinder. With a mixture of hydrogen and oxygen, or of coal gas and air, the condensation is effected by means of explosion with an electric spark or a gas jet; with ammonia the gas is alternately expanded by heat and condensed by cold water. Many forms of gas engines have been invented. Also called *gas motor.*"

This definition requires more than a grain of salt with it—in fact, a grain of salt and an onion would hardly season it so as to make it acceptable to the gas engineering taste of the present time.

In a gas engine motion is not communicated to the piston by the alternate admission and condensation of gas in a closed cylinder. The gas-engine cylinder is not "closed"; it is closed at one end and open at the other. Motion is not communicated to the piston by the "alternate" admission and condensation of gas. The gas engine does not "condense" anything.

The compressed combustible charge in the combustion chamber of a gas engine is not "condensed" when the charge is ignited with an electric spark or a "gas jet," and the use of the gas jet as an igniting agent has been long abandoned. When the combustible charge in the combustion chamber of a gas engine is ignited, either by an electric spark or by contact with an incandescent tube, the charge takes fire and burns very rapidly, so rapidly that it may be said to explode. This rapid combustion of the compressed charge greatly increases its temperature and pressure, and makes the ignited charge available as a motive agent to drive the piston towards the open end of the cylinder in its working stroke.

A fairly correct brief definition of "gas engine" would read as follows:

"An engine in which motion is communicated to a piston, working in a cylinder closed at one end, by first compressing a combustible charge of air and gas in the closed end of the cylinder and then igniting this compressed charge by an electric spark or an incandescent tube, and so increasing the temperature and pressure of the compressed charge by combustion as to make it available for driving the piston outward in its working stroke."

Much more might be said in regard to this highly important form of prime-mover, which is now largely taking the place of the steam engine; but what is given is correct so far as it goes, and is short enough to go into the space now occupied by the really ridiculous definition given in the "Century."

How did this grotesquely absurd "Century" definition come to be written?

It was proposed early in this century to produce a vacuum by the combustion of gas in a cylinder, and use this vacuum to move a piston by the unbalanced pressure of the atmosphere, and I have seen a statement that such a motor was constructed and applied, with no great measure of success of course, to a mechanically driven road wagon. If such was the case, it would be easy for some academic savant to print this vacuum gas engine in a book, and this once done it would be quite the expected thing for another academic savant who was given "gas engine" to define, to rake up this old book story and "condense" it for the "Century Dictionary," because the truly scientific academic mind prefers books (the older the better) to things actually existing.

HUGH DOLNAR.

A Pattern With Curves of Large Radius.

Editor American Machinist:

I send herewith a sketch of a pattern with a curve at the bottom the radius of which is nearly 35 feet. As I would have had to take it out doors to use a tram on the job I adopted the following plan:

Fig. 2 shows the method of finding points in the curve at which to drive some fine nails, and then by bending a strip of wood so that it touched at least three of these points it was easy to run the pencil along, describing the curve required. From the center of the chord a quadrant is described, its radius equal to the hight of the required segment. The quadrant is divided into any suitable number of equal parts, in this figure three; so also is that part of the chord cut by the quadrant. Join these points as lines 1 and 2 show. Now divide each half of the chord into the same number of equal divisions, and erect lines at the points thus found parallel to lines 1 and 2 in the quadrant, and the hights of the latter must be marked off on the former. That gives the points for nails to be driven as guides for bending the strip.

In making the pattern, Fig. 1, to insure that it should be true and that it would not shrink, I first got out three ribs 1¼x4½ inches, and lengths as shown, forming them into a truss; then boarding over at an angle with ⅞-inch stuff on one side and filling in with 1¼-inch on the other, with the angle reversed, after truing and planing to the thickness, gave a good job for the web. The top flange was ½-inch stuff fastened on and fillets worked afterwards. The bottom rib was worked carefully on the inside, screwed and glued on. The outside curve was marked by laying on a template previously shaped to the case in hand, then band-sawed with draft allowed, and very little work but sandpapering afterward. I had to fasten a temporary strip 1½ inches thick on the under side for convenience while sawing.

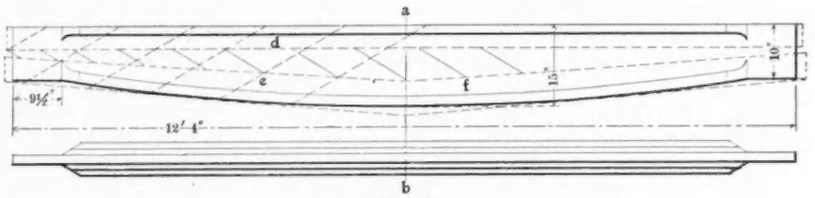


Fig. 1

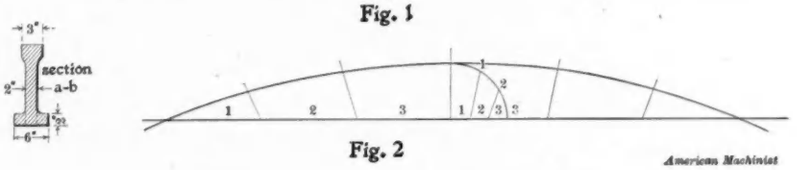


Fig. 2

American Machinist

A PATTERN WITH CURVES OF LARGE RADIUS.

Oneonta, N. Y. WM. NEWTON.

An employees' aid fund, having a surplus earning over $30,000 a year in dividends, is a novelty. That is the condition of the fund started at the organization of the Calumet & Hecla Mining Company, when the company required single men to contribute 50 cents a month and married men $1 to a benefit fund. Medical attendance and medicines were furnished out of this fund, as also $500 to the family of any employee whose death resulted from accident. In addition to this, a fine hospital was built. Nevertheless, the money continued to accumulate and the surplus was invested in the stock of the company, until now the fund owns 475 shares, the income from which is about enough to pay expenses. The company relieved the employees from the payment of assessments in 1897, itself contributing the money. It has continued this policy to date, and recently announced that it would be responsible for the assessments in 1900.

Legal Notes—Defective Drop Press and Planer.

Two cases were recently decided on appeal by the Superior Court of Pennsylvania in which Louisa Valentine in her own right and as mother and next friend of Louis Valentine was plaintiff and The Colburn Company was defendant. Louis Valentine, nineteen years of age, was employed by the defendant, and part of the time worked at a stamping machine, which at other times was operated by other employees. The plaintiff was engaged in stamping tin cans. If the machine was in proper condition the stamp would cease to work as soon as the operator's foot was removed from the treadle. A can which had been stamped stuck, and while he was endeavoring to remove it the die suddenly descended while his foot was not on the treadle, and severed his thumb. The defendant contended that the evidence did not establish the fact that there was a defect in the machine; that if the machine was defective there was no evidence of notice to the defendant of the existence of the defect, and that the plaintiff was guilty of contributory negligence. It was conclusively established that if the machine was in order the stamp could not fall unless the foot was pressed upon the treadle. An expert testified that when these machines were worn out and old they might make one extra stroke such as injured Valentine's hand, and three other witnesses testified that this machine had often made this irregular stroke before, and that the machine had been in this defective condition for several months. A witness testified that prior to the accident he had noticed the defect in the machine; that he complained to the foreman, who, in his presence, reported the matter to the manager of the department. The court held that this was sufficient evidence to go to the jury, and that there was no evidence which would have justified the court in taking the case from the jury upon the ground of contributory negligence of the plaintiff. The Appellate Court therefore affirmed the judgments of the lower court and the verdicts of the jury of $500 respectively in favor of the plaintiffs (10 Pa. Sup., 453).

A short time ago a judgment of $2,000, recovered by Charles W. Denning against the Midvale Steel Company as damages for personal injuries resulting from the negligence of the defendant steel company, was affirmed by the Appellate Court of Pennsylvania. The plaintiff was engaged in work on a planer in defendant's steel works, which was planing a piece of steel. The plaintiff walked about 8 or 10 feet from the planer to a lunch box, and as he turned around he was struck in the eye by a steel chip from the machine. It appeared from the testimony given that the machine threw chips only when there was lost motion in the saddle, arising from a loose condition of the parts which composed it, the remedy for which was a tightening up of those parts. The plaintiff was an experienced machinist; he had been running the machine in question for some time and knew that it had a habit of throwing chips when out of repair and that it was out of repair at the time of the accident. The defendant contended that when the plaintiff went to his lunch box and turned around facing the machine, he knowingly placed himself in a position of danger, and that he was therefore guilty of contributory negligence. There was no proof that the machine had ever thrown chips as far as the position in which plaintiff stood at the moment of the accident, and there was testimony to the effect that such machines would throw chips when the tool was working in very hard steel, only for a very short distance, ordinarily a few inches, and not more than a foot. The court held that these circumstances did not indicate that the plaintiff knew or had reason to believe that the machine was then throwing chips, or that they could strike him at so great a distance, and that therefore the question of the plaintiff's contributory negligence was properly left by the trial court for the jury to determine, and that if the jury found a verdict for the plaintiff the judgment in his favor should be affirmed (192 Pa., 182).

Noticeable Features of Lancashire 1899 Trade.

The past year has been an altogether remarkable and quite exceptional period throughout every section of industry connected with the engineering, iron and coal trades of Lancashire. When the year opened all branches of engineering were still feeling the great rush of work following up the prolonged strike of 1897, and all through the past twelve months there has been an unbroken pressure, except in some of the textile machine trades and here and there among heavy stationary engine builders. One effect of the prolonged strike was to largely stimulate the introduction into this country of numerous types of American automatic machine tools, and so far as the American manufacturers have been able to meet the English demand this has not since shown any falling off, but rather an increase. Many of the leading Lancashire machine tool makers naturally "pooh-poohed" this introduction of American tools, as not in any way affecting the high class British engineering and machine tool trades. One well-known representative of the best Lancashire makers of machine tools, during an interview, was quite contemptuous as regards the importance which had been attached to American tools coming into England. These American automatic tools, he said, were of little or no consequence; they were simply machines useful for making what might be termed the "trimmings" for general engineering work, such as nuts and bolts, and other small details, but they did not touch the really high-class machine tools for general work. It is, however, surprising to find how many of these American machine tools are now to be found even in the shops of the leading Lancashire machine tool makers, and in passing through one of these recently I noticed a whole room entirely fitted with American tools which were operated by youths, under the control of a single foreman.

As to the iron trade, without attempting any detailed review of the past twelve months beyond mentioning that raw material has advanced 25s. to 27s. per ton, finished iron £3, and finished steel from 25s. to £2 per ton, there are one or two noticeable features of special interest. The chief of these has been the withdrawal of American competition in various directions. In pig iron there has been quite a disappearance of further importations of American brands, which, during the preceding year, had a very considerable influence upon the market here. In place of sending further supplies over here, United States makers have in many cases been only too anxious to cancel contracts by paying premiums of 8s. to 10s. on the prices at which the dealers and consumers had purchased the iron in the States. In the hoop iron trade there has also been less keenness of competition on the part of American makers. Some years ago Lancashire had a very important export trade in hoops with the United States, perhaps approaching 30,000 tons per annum. This was, however, entirely swept away by the much lower prices at which American hoop makers were able to quote. During the second half of the past year, however, American inquiries came pretty freely on the market here, and some tolerably large orders were booked at good prices for delivery in the United States. In the wire rod trade a somewhat similar state of things prevailed. American manufacturers, who had previously been cutting prices exceedingly low, withdrew altogether from the market, and Lancashire makers have had no difficulty in filling their books with orders for shipment abroad at very considerable advances on previous prices.

With the exceptional activity in trade during the past twelve months commercial and industrial combinations have come to the front. The bar iron makers, following the hoop manufacturers, have formed an association for regulating prices, and have introduced clauses into their contracts with merchants stipulating that they shall not resell at any time at under the then current standard prices. The iron merchants have also formed an association for the protection of their special interests, and no doubt so long as trade is sufficiently active the various combinations will run on smoothly enough to the mutual satisfaction of both manufacturers and merchants. The coal workers and the coke makers have also formed

their associations, and the Lancashire collieries have taken up the position of declining to contract with merchants at any fixed prices, but only for deliveries of specified quantities, prices to be fixed when deliveries are made, in accordance with the then current market rates. Merchants generally, however, have not been at all ready to contract under such terms as the above, preferring for the most part to take their chances in the open market.

A Quick English Shipment.

Our trans-Atlantic friends are "bracing up," and the world should know it, so that it is more or less our duty to reproduce the following account of a recent achievement. We find it in "The Engineer and Iron Trades Advertiser," Glasgow:

"The War Office recently required for immediate shipment to South Africa the following narrow-gage railway rolling stock: Two locomotives, 5 miles of railway, 1 mile of curved railway, 30 sets of points and crossings, 24 ballast wagons, each to carry 2½ tons, 15 eight-wheeled bogie wagons, each to carry guns and gun carriages weighing 6 tons, and two special bogie brake wagons. Each wagon was to be provided with brake, with central spring buffer and draw gear, and all were of new and special design. The tender of Mesrs. Kerr, Stuart & Co., Limited, of London, whose works are at Stoke-on-Trent, was accepted, their specified time for delivery being ten working days. The order for this material reached London and was telephoned to the works at Stoke-on-Trent on Saturday morning, November 18. A small portion only of the material required for the purpose of the order was in stock at the works. The locomotives had been put down in the erecting shop on the 15th of November, and were intended for the Egyptian Government for the barrage works, and would have been finished in the ordinary course in four or five weeks from that date. The permission of the inspector for the Egyptian Government to use these locomotives having been obtained, the two locomotives were completed and tested in steam before the Inspector of Iron Structures and two other inspectors from the War Office on Tuesday, the 21st, within three days from order. Five miles of railway, with steel sleepers, two locomotives, and 24 ballast wagons, with steel underframes and drop sides, were manufactured, painted, packed and loaded into trucks at the works of Messrs. Kerr, Stuart & Co., Limited, before eight o'clock on Wednesday night, the 22d, the time occupied being from Saturday to Wednesday, inclusive, or four working days. The wheels for these wagons were of chilled cast iron, one of the specialties of two well-known firms in Edinburgh. The wheels made during the day by these firms were handed to the railway company in Edinburgh at 6 P. M., and were placed duly in a wagon and attached to a passenger train reaching Stoke-on-Trent at eight o'clock the following morning, where they were immediately bored and keyed upon their axles. The greater portion of the order was shipped at Birkenhead on board the steamer within four working days from the receipt of the order at the works. The balance of the order was completed well within the time named, was inspected, passed, and is now well on its way to the Cape."

The Paris Exposition.

It is gratifying to note that preparations for the representation of the industries and products of the United States at the Paris Exposition continue on an elaborate and comprehensive scale.

According to Commissioner-General Peck, there will be in the American sections at Paris over 7,000 exhibitors, from every State in the Union—a number ten times as great as those which were represented in Vienna in 1873, six times as many as those at Paris in 1878, and four times as many as those who exhibited at Paris in 1889.

A word of advice to those manufacturers who purpose making exhibits may not be out of place. Those who intend to prepare special catalogs or circulars for that occasion would do well to bear in mind that weights and measurements in metric units will be most familiar to the majority of those who will visit the exposition. The effect upon those who will receive such printed matter will be more favorable if the metric system shall be used instead of our own system of weights and measures, with which the world, outside the English-speaking countries, is comparatively unfamiliar. Catalogs and circulars should be printed in English and French, as those two languages will probably be familiar to the majority of the visitors. German will come next in order of importance, and Spanish will rank fourth. A. F. T.

An Alloy of Aluminum.

Since the publication in our issue of November 9 of an account of what W. A. McAdams, of Brooklyn, was doing with alluminum alloys, we have had the pleasure of an interview with that gentleman and a chance to see some of the castings produced by him, and to note their behavior. Mr. McAdams showed us a spool-shaped casting, for instance, made of an alloy of aluminum, copper and tin, which is white in color, very light, and in fact would be taken casually for aluminum. When placed upon a solid object and struck with a hammer one soon discovers, however, that it is quite different from aluminum, and in fact seems to act more like steel, being manifestly very much stronger than the best gray iron castings, and having besides a very much higher elastic limit. At the same time a similar casting made of exactly the same alloy, but cast in sand, was shown to us, and this, instead of having a fine grain like steel and being very strong, had a very coarse-grained fracture and was not nearly so strong. The metal is about as malleable as brass; its specific gravity is 3.39, or considerably less than half that of brass or cast iron. The metal works well under the tool, polishes nicely, wears well, conducts heat and electricity well, melts at 525 C. or 977 F., has small shrinkage, welds by electricity, does not tarnish or rust, resists nitric and sulphuric acids and mercury and has great crushing strength. The alloy made by Mr. McAdams' method seems to promise a valuable addition to the list of available materials of machine construction. Mr. McAdams informs us that he does not yet consider it to be entirely beyond the experimental stage. He knows a good many things about it, but wants to know more before he stops experimenting.

Technical Publications.

"The Mechanical Engineer's Pocket Book." By William Kent. Fourth edition, revised. 1,100 4x6¾-inch pages, with 168 illustrations. John Wiley & Sons, New York. Price $5.

We are glad to see that Mr. Kent is applying that process of periodical revision to his work which is necessary to keep it up to date. The present edition is not materially larger than the old, the changes being mainly in the line of revision rather than addition, although new matter under the heads of Fans and Blowers, Flow of Air in Pipes and Compressed Air has been added. Many new tables appear in place of the old ones, and several sections have been rewritten. The index, which in the old edition lacked fullness, has been enlarged about 50 per cent. The work is simply monumental in its character, and the engineering public is under lasting obligations to its author for its preparation.

"American Telephone Practice." By K. B. Miller. 458 6x9-inch pages, with 357 illustrations. The American Electrician Company, New York. Price $2.

This is a very complete and painstaking description of telephones and telephonic apparatus. The author states that the course of development of telephonic principles, as embodied in successive instruments, was strictly logical, and that a description of the leading instruments in the historical order of their appearance is excellently adapted to the study of the principles involved. In the early chapters he follows this method, without, however, including discarded devices which did not include new principles bearing upon the general line of development. The treatment is non-mathematical and may be read by anyone possessing a limited knowledge of the principles of electricity.

The impression of the magnitude of the telephone and of the apparatus auxiliary to it, considered as a series of inventions, is forced home to the reader on almost every page.

Personal.

James Owen, formerly draftsman for the Emerson Manufacturing Company, of Lawrence, Mass., and later connected with the E. D. Jones Company, of Pittsfield, Mass., has accepted a position at the New York Navy Yard.

D. T. Anderson has been engaged as foreman of the die department of the Toledo (Ohio) Machine and Tool Company's shops. Mr. Anderson has had a wide experience with some of the most prominent concerns in the line of sheet metal die work and tools for making stampings.

Obituary.

John Henry Lester, an inventor and a pioneer manufacturer of sewing machines, in which business he acquired a fortune, died in Brooklyn January 10, eighty-four years old. He was born in Connecticut, and went to Brooklyn when twenty years of age. Just before the Civil War he opened a machine shop in Richmond, Va., organizing a stock company for building wood-planing machines. The shop was taken and paid for by the Confederate Government, and Lester received an appointment as purchasing agent. He came through the lines to the North, and although he turned over all his papers to the Federal authorities, he was imprisoned for a long time, being finally released or pardoned by President Lincoln. A suit which he instituted against the government was finally dismissed.

Samuel Dana Greene, assistant general manager and general sales agent of the General Electric Company at Schenectady, N. Y., was, with his wife, drowned January 8, in the Mohawk river, they having skated into an opening left by ice harvesters. The bodies were immediately recovered. Mr. Greene was but thirty-five years old. His father was Commander Samuel Dana Greene, who was second in command of the "Monitor" in her fight with the "Merrimac." Mr. Greene gradu-

(*Continued on page 40.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Rawhide, fibre and hard rubber gears. The Arthur Co. (See page 8.)

For Sale—13 in. Barnes lathe, 20 in. drill, fine condition. S. K., AMERICAN MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Parallel attachments for drawing board or table $1.50. F. G. Hobart, Beloit, Wis.; cir'lrs.

For Sale—1½ H.-P. gasoline engines, $50; castings and blueprints, $15. 399 Goodrich ave., St. Paul, Minn.

Wanted—8 or 10 ft. boring mill; must be in first-class condition. Address Box 127, AMERICAN MACHINIST.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—An 8, 10 or 12-foot mill; must be in good condition. W. A. Jones Fd'y & M. Co., 55 So. Jefferson st., Chicago, Ill.

Manufacturers of molding machinery for foundry use are invited to mail their catalogs addressed to "Foundry," care AMER. MACH.

For Sale—Two geared Ferracute presses, 62 in. between uprights; little used, and in good condition. Address W. H. Mullins, Salem, Ohio.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Mechanical engineer solicits correspondence with capitalists or manufacturing concerns who want to build an improved high-speed engine. Box 110, AMERICAN MACHINIST.

Our entire plant destroyed by fire; request correspondence with manufacturers of machine tools and dealers in second-nand lathes, planers, drill presses, etc., with lowest cash prices. Fayetteville Iron Works & Machine Shop, Box 137, Fayetteville, Ark.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wanted—A first-class business man with capital, to take charge of a foundry and machine shop now manufacturing special machinery; the above shop is in the hands of a receiver; if the right man is found, a company can be organized and capital raised by people whose influence will keep the factory in work at all times. Address Box 126, AMERICAN MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Draftsman (mechanical) wants position. O. S., 439 Henry st., Brooklyn, N. Y.

Engineer's assistant desires similar position; 10 years as draftsman. Box 129, A. M.

Mechanical engineer, experienced, is open for engagement; references. Address Box 111, AMERICAN MACHINIST.

Foremanship of iron foundry, by foreman, experienced on engine and general jobbing work. Box 135, AMERICAN MACHINIST.

Position as chief draftsman or superintendent; slide valve and Corliss engines, air compressors, etc. Box 119, AMER. MACH.

Situation wanted by a first-class machinist with inventive ability, on experimental or model work; 19 years' experience. Box 134, AMERICAN MACHINIST.

Stock clerk or storekeeper, thoroughly experienced in machine-tool work and general engineering, desires sit tion. Box 130, AMERICAN MACHINIST.

Position as foundry foreman by up-to-date foundryman, experienced on loam, dry and green sand work, melting, handling men, etc. Box 136, AMERICAN MACHINIST.

Superintendent, experienced in pumps, air compressors, small steam engines and valves; familiar with latest shop practice; up-to-date man. Box 131, AMERICAN MACHINIST.

Wanted—Position by foundry foreman, experienced on locomotive and Corliss engine, mining and cotton machinery castings. Address "Castings," Box 133, AMER. MACHINIST.

Mechanical engineer, 15 years' experience selling, designing and office management, pump and engine work, technical trained, open to engagement February 1. Box 109, AMERICAN MACHINIST.

Wanted—Position on the Exposition in Paris; experienced in machine tools, pumps, etc.; thoroughly familiar with France and Germany; first-class salesman. Box 132, AMERICAN MACHINIST.

As superintendent or chief draftsman; specialty printing presses and other intricate mechanisms; thoroughly efficient, systematic and inventive; excellent record. Address "Executive Ability," AMERICAN MACHINIST.

Mechanical engineer, with 18 years' experience in heavy transmission machinery, steam engines, hydraulic engineering, general machinery and structural work, wants position; references. Address "Technical Graduate," AMERICAN MACHINIST.

Engineer and machinist, with 5 years on high-grade engines and 11 years on general repairs, desires correspondence with large manufacturing plant; at present M. M. in cotton mill; object, larger position. Address C. H. Wolcott, Box 165. Griffin, Ga.

Help Wanted.

Hammersman, with thorough experience on drop-forge work and welding; good and steady position. Address Box 137, AMER. MACH.

Wanted—Toolmakers on tools for small interchangeable work; state age, experience and wages expected. Box 114, AMER. MACH.

Foreman molder wanted on good machine castings in green and dry sand, to compete with the market in quality and price. N. B., 703 Beard Building, New York.

Wanted—Working tool-room foreman, experienced on tools for valves and fittings; state age, experience and wages expected. Box 138, AMERICAN MACHINIST.

Draftsman wanted; one who has worked on light machinery; must be a young man who has had successful experience; locality, New York city. Address Box 128, AM. MACH.

Foreman machinist, to take charge repair shops of steel works; must be experienced mechanic with best references. Lukens Iron & Steel Co., Coatesville, Pa. (38 miles west of Philadelphia).

Machinists—A few machinists can secure positions in a good shop about one hour's ride from New York city; on lathe, vise and all-around work. Write, stating experience and qualifications to Box 89, AMER. MACH.

Wanted—Good, all-round draftsman; previous experience with hydraulic machinery and gasoline engines will be a recommendation; permanent position to right man. Address, with full particulars, James Lang, 172 Crawford st., Toronto, Canada.

Wanted—By a manufacturing company, 50 miles from Chicago, six good machinists to work on moderately light machinery; steady employment and the best wages will be given to the right men. Address promptly Western Cane Seating Co., Michigan City, Ind.

Wanted—Two or three practical mechanical draftsmen accustomed to machine design; one must be experienced in light experimental work; state age, experience, where obtained; will pay good salary to capable men. Address, by letter only, Thomas A. Edison, Orange, N. J.

Wanted—Foreman for machine shop who has had experience in handling men, and the manufacture of special piercing and forming dies, reamers, tit punches, etc., also fine machine tools; only men of good ability need apply; position permanent. Address Foreman, care AMERICAN MACHINIST.

Wanted—For a machine tool shop in Ohio, a competent designing draftsman, foreman for tool-making department, foreman for turret-lathe department and operators for Jones & Lamson flat turret lathes and Landis universal grinding machines; state age, experience and wages expected. Box 117, AMER. MACH.

Leading manufacturing firm in England, about to start the manufacture of alternators and continuous-current generators, have appointment open for leading position as designer and constructor of continuous-current plant; must be thoroughly experienced designer and must have held similar appointment before; good salary offered; give references. Address Box 139, AMER. MACHINIST.

Wanted—By a machine shop in Central Ohio, a hustling, first-class superintendent, full of good ideas for simplifying the manufacture of specially designed light and heavy work; must be able to handle about 80 men successfully; sober, industrious, truthful, age 32 to 48, with large experience; good wages paid right man; state fully your capabilities and reasons for quitting your present position; none but competent persons need apply; answers made only to those thought to fill the requirements; all correspondence treated confidentially. Address "K. L.," care AMERICAN MACHINIST.

(*Continued from page 39.*)

ated from the United States Naval Academy at Annapolis in 1883 with high honors, and he remained in the navy until 1888, when he resigned to engage in electrical engineering. He was for some years chief engineer of the Sprague Electric Railway and Motor Company, and resigned to connect himself with the General Electric Company. Mr. Greene's wife was a daughter of Rear Admiral Chandler, U. S. N.

Inquiry for Machinery.

(118) Names and addresses of makers of machinery and tools used in the manufacture of celluloid hooks and eyelets.

In these days of wars and rumors of wars we are so far from beating our swords into plowshares and our spears into pruning hooks that the very reverse of this process seems to be in active operation. The talk is of quick-firing guns, of smokeless powder and of shells charged with high explosives, but, as a matter of fact, those at the front are just now thinking quite as much of barbed wire as of anything. It is decidedly unpleasant to be tangled up in the stuff in the face of a blazing battery, or within a few yards of long lines of trenches. Both the Boers and the English are using large quantities of barbed wire, and it is said that the stock of wire nippers in the London market has been entirely sold out, while the Sheffield factories are working hard to supply the demand.

A peculiar accident by which a man was instantly killed is noted as having recently occurred at Point St. Charles, Canada. The man was ramming ashes into a cylinder, and the iron rod having stuck it was jerked up quickly, the end breaking the globe of an arc light immediately above and forming a circuit so that the current passed through the man's body.

The business of Ad. Janssens, Paris and Brussels, has been formed into a company, registered in Paris on the 30th of December last, with a capital of one million francs, Mr. Janssens reserving the direction for a period of six years. The title is "Establissement Adolphe Janssens."

Some of our friends in Great Britain who think we are sometimes a little severe in our criticisms of British shop practice might do well to read the article in "Engineering" of January 5, signed with the rather queer cognomen of "A Practical Exporter." The contributor devotes over a page of our contemporary to telling his countrymen just what he thinks is the matter with their shop practice, and it is chiefly a social difficulty, according to his way of thinking.

MECHANICAL ENGINEERS AND DRAFTSMEN

WANTED.

Capable and Experienced Men should become acquainted with us.

Our business is to secure good positions for first-class mechanical, civil and electrical engineers and draftsmen.

WRITE US, stating your experience briefly, and we will send you the necessary papers to be filled out in full.

The Engineering Agency,
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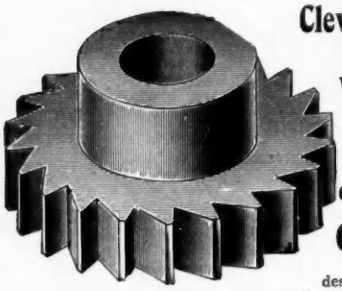

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Located on C. & O.R.R. in Iron, Coal and Lumber district of W. Va. Large repair business to be had.
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Just as rigid and strong as it looks, and just the tool to use for all sorts of small forging, cutting and stamping operations, etc.

Powerfully geared and finely fitted; frame in one solid piece. Built in various sizes with details modified to suit various requirements. Send for Descriptive Circular.

DOUBLE CRANK PRESS.

Philadelphia Machine Tool Co.,
447 N. Darien St., PHILADELPHIA, PA., U.S.A.

Extra Heavy Rough Brass Unions

And BRASS CASTINGS For All Purposes.

Phosphor Bronze for Machine Box Bearings, Etc.
Special Finished Brass Work to Order.

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or machine parts, by contract, and to finish first-class Brass Castings. We have a Modern Machine Shop, Brass Foundry and Coppersmith Shop, and every facility for doing these things well. Tell us what to figure on.

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SAM'L M. NICHOLSON, Pres. & Gen. Mgr. .....LARGEST MAKERS IN THE WORLD.

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The Fairbanks Co., Philadelphia, Pa.
Pratt & Whitney Co., Chicago, Ill.

De Fries & Co., Dusseldorf and Berlin, Germany.
A. Janssens, Paris, France.
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Burton, Griffiths & Co., London, Eng.
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WHEN YOU ARE TOLD THAT JENKINS' '96 IS MORE EXPENSIVE THAN OTHER PACKINGS.

Average weight ⅛ inch "Jenkins '96," 11 lbs. to the square yard.
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At 60c. per pound "JENKINS' 96" is not only very much cheaper, but the best joint packing manufactured.

JENKINS BROS. NEW YORK, BOSTON PHILADELPHIA, CHICAGO.

By the Year.

Carborundum costs most at first—
costs least by the month, or year.
Carborundum cuts faster, cuts cleaner—does more work and better work than any other abrasive.
Ask us for proof.

The Carborundum Company, **Niagara Falls, N. Y.**

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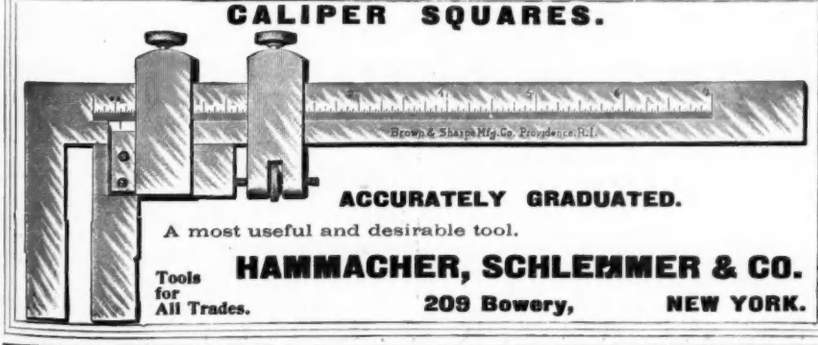

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Steam-Boiler Practice In its relation to **Fuels and their Combustion** and the **Economic Results Obtained with Various Methods and Devices.** By WALTER B. SNOW, S. B., Member American Society of Mechanical Engineers. x+297 pages; 24 figures. 8vo. **Cloth, $3.00.** Order through your bookseller, or copies will be forwarded postpaid by the publishers on receipt of the retail price.

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Genuine Lightning Screw Plates,
Taps, Dies, Reamers, Green River Screw Plates, Bolt Cutters, Drilling Machines, etc.
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We may before long be exporting and importing electricity. At Niagara Falls American parties want to furnish current on the Canadian side, and some Canadians propose to sell power on the American side of the river. The question has come up at the United States Treasury as to whether electricity is dutiable. The decision may have some bearing upon future investments at the Falls. As the Department some years ago rendered a decision that natural gas is not dutiable, because it is not an article, electricity would seem to be more certainly exempt.

The twenty-first annual meeting of the Engineers' Club, of Philadelphia, will be held on the evening of Saturday, January 20, at the headquarters, 1122 Girard street, Philadelphia. Mr. Francis Schumann, the retiring president will on that occasion deliver the annual address.

During the trial a few days ago, in England, of the steam turbine-driven torpedo-boat destroyer "Viper" a speed of 35.5 knots was attained. This is one-half knot more than the contract called for.

"America, Germany and England," mused the diplomat. "What a grand combination that would be together."

"Just like a tugboat engine," said the great lumber merchant.

"In what way, sir?"

"Triple expansion."—Chicago News.

New Catalogs.

The American Iron & Steel Manufacturing Company, Lebanon, Pa., sends us catalog describing various kinds of bolts, nuts, rivets, forgings of all kinds, etc. The catalog is standard size, 6x9 inches.

New Process Twist Drill Company, Taunton, Mass., sends us catalog in which are described twist drills as made by them, cases for same, chucking reamers, twist drill gages, etc. The catalog is standard size, 6x9 inches.

Grant Machine Tool Works, Cleveland, Ohio, sends us copy of Catalog "B," which contains descriptions and illustrations of machine tools of various kinds. These include hand lathes, worm wheel hobbing machine, radial drills, plain milling machines, etc. The catalog is standard size, 6x9 inches.

We have received from the Philadelphia office of the A. A. Griffing Iron Company a copy of Catalog "SB," in which a somewhat complete line of steam specialties is illustrated and described, including oil separators, low-water alarms, steam traps, exhaust heads, etc. The catalog is ½x6½ inches.

We have received from the Crescent Steel Company, Pittsburgh, Pa., a booklet devoted to the description of the exhibit made by that company at the recent National Export Exposition in Philadelphia. In addition the booklet contains a number of testimonial letters from users of Crescent steel. It is 3x6 inches.

H. H. Franklin Manufacturing Company, Syracuse, N. Y., has issued a small catalog in which are described and illustrated various forms of finished castings made by a new process and which avoids machine work. The

metal from which these castings are made has by test been shown to be about as strong as cast iron. The catalog is neatly gotten up and is standard size, measuring 3½x6 inches.

Manufacturers.

A new concern, Odds & Hough, is to locate a gasoline engine factory at Albion, Mich.

Charles Edgerton, engineer, has submitted plans for an iron factory building for the American Product Company, at Morris street, Philadelphia, Pa.

The National Gas Construction Company, of Philadelphia, Pa., is receiving estimates for the erection of a brick power-house to be erected at Greenville, S. C.

J. W. Gray, Thomasville, N. C., is putting the framing lumber on the lot for his new factory, which will be 36x80 feet. Two other factories will also go up in the spring.

The stockholders of the York Manufacturing Company, of York, Pa., met recently and increased the capital stock from $600,000 to $1,000,000. The object is to enlarge the plant.

The S. A. Woods Machine Company, of Boston, Mass., owing to an increased demand for its machines, has just erected an addition to its plant, which will enable it to increase its output by about one-third.

A large electric lighting and water plant is contemplated at Westfield, N. J., at an estimated cost of $100,000. This will include the erection of power-house, with necessary machinery, pumps, dynamos, etc.

The factory building of Messrs. M. & J. Metzger, on Leverington avenue, Manayunk, Pa., is to be enlarged by the erection of a five-story and basement brick and iron building, which is to measure 40x60 feet.

Architect Thomas Stephens, of Camden, N. J., has completed the drawings for the electric power-house building to be erected at Camden, N. J., for the Camden & Suburban Railway Company, costing about $15,000.

The Ranney Refrigerator Company, of Greenville, Mich., is pushing along the building of its new factory despite the winter weather, and expects to be running by March. The building is 90x150 feet, three stories, and will employ 100 men.

The Monongahela Consolidated Coal & Coke Company has decided to erect three electric power-houses at different points along the river to furnish power for the operation of its mining machinery. The plants are to go up at Gastonville, Brownsville and Monongahela, Pa. The stations will cost about $150,000.

The Ludlow-Saylor Wire Company, which recently purchased 60,000 square feet of ground on Newstead avenue, St. Louis, Mo., is having plans prepared by Eames & Young, architects, for a new plant and warehouse to cover practically the entire ground, and to cost about $75,000.

The Filer & Stowell Company, Milwaukee, Wis., is now seeking to have a strip of land about 27 feet wide and 1,260 feet long adjoining its plant, vacated, so that it may build an extension of its factory upon it. This will begin at once upon the vacation of the street. It will cost close onto $100,000, and the company will be enabled to give employment to 250 extra men.

The Ohmer Car Register Company, of Rochester, N. Y., are equipping a manufacturing plant in Dayton, Ohio, for the manufacture of fare registers. They expect to start with a capacity of 500 registers per month, and claim to have enough orders ahead to run a year. They will install only modern machinery. Supply men should address the managing office at Dayton, Ohio.

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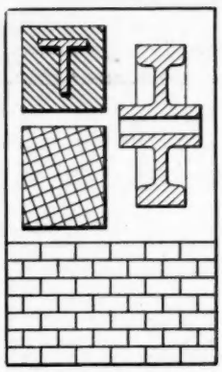

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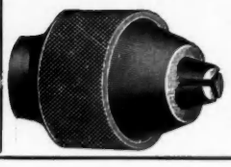

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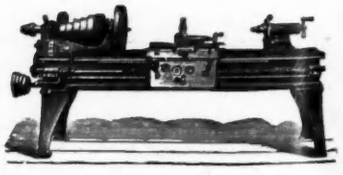
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